A330
TECHNICAL TRAINING MANUAL
MECHANICAL & AVIONICS COURSE - T1+T2 (LVL 2&3)
(RR Trent 700)
PNEUMATIC

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PNEUMATIC

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G9409341 - GAUT0T0

PNEUMATIC LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW

The pneumatic system is used to supply air to various A/C systems. This module will review:
- the system sources and users,
- the engine APU and High Pressure (HP) ground unit bleed air management system,
- the leak detection system,
- and the control and indicating.

This module will also introduce some typical line maintenance activities.

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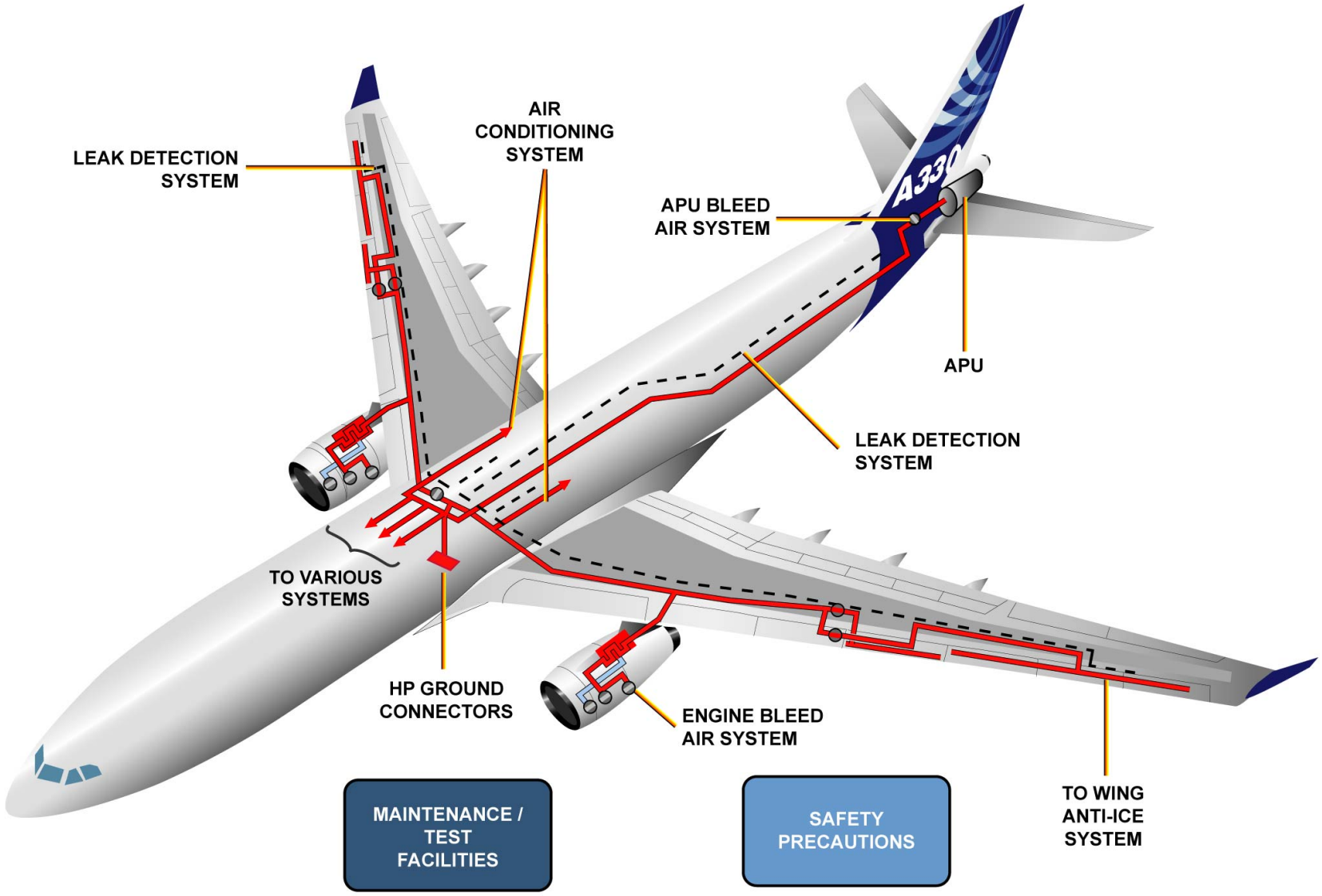

SYSTEM OVERVIEW

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PNEUMATIC LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

SOURCES AND USERS

The pneumatic system is used to supply temperature and pressure regulated air to various A/C systems.
The pneumatic system may be supplied with HP bleed air from 3 types of sources:
- ground cart,
- APU,
- engines.

The bleed air is distributed to different users via a distribution and supply ducting network. These users are:
- the water system pressurization,
- the hydraulic reservoir pressurization,
- the wing anti-icing system,
- the engines starting systems,
- the air conditioning compartment ventilation system,
- the air conditioning packs.

The pneumatic system operates pneumatically and is monitored by two Bleed Monitoring Computers (BMCs) 1 and 2.
There is one BMC for each engine bleed system. Both adjacent BMCs exchange data. If one adjacent BMC fails, the other BMC takes over most of its monitoring functions.

ENGINE BLEED

The engine bleed air is pressure and temperature regulated prior to supplying the pneumatic system. Air is bled from two engine High Pressure Compressor (HPC) stages, the Intermediate Pressure (IP) stage and the HP stage.
The HP bleed is only used when the engines are at low power. The Intermediate Pressure Check Valve (IPC) and High Pressure Valve (HPV) control the bleed air supply. Once the IP bleed is sufficient, the HPV closes and the IPC opens.

All the engine bleed air is supplied to the pneumatic system through the main engine bleed valve (or Pressure Regulating Valve (PRV)), which acts as a shut off and overall system pressure regulating valve. Each BMC monitors system pressure and will shut down the engine bleed in case of excessive pressure. In addition, an OverPressure Valve (OPV) is installed downstream from the bleed valve to protect the system in case of overpressure.
The temperature of the engine bleed air is regulated to a maximum value. The hot bleed air goes through an air-to-air heat exchanger called the precooler. Fan discharge air modulated by the Fan Air Valve (FAV), blows across the precooler to maintain the temperature within limits. Each BMC monitors the system temperature and will shut down the engine bleed in case of excessive temperature.

APU BLEED/EXTERNAL AIR SUPPLY

The APU can also be used for bleed air supply. This is usually done on the ground for air conditioning and for engine start. However, APU bleed air may also be used in flight, depending on the altitude. The APU bleed supply is connected to the left side of the crossbleed duct. The crossbleed valve opens automatically to supply the right hand side when the APU bleed is supplying the system.
On the ground, an HP ground power unit can be connected to the left hand side pneumatic system. The right hand side may be supplied by opening the crossbleed valve. A crossbleed duct connects the left and right bleed systems. A crossbleed valve enables their interconnection or isolation.

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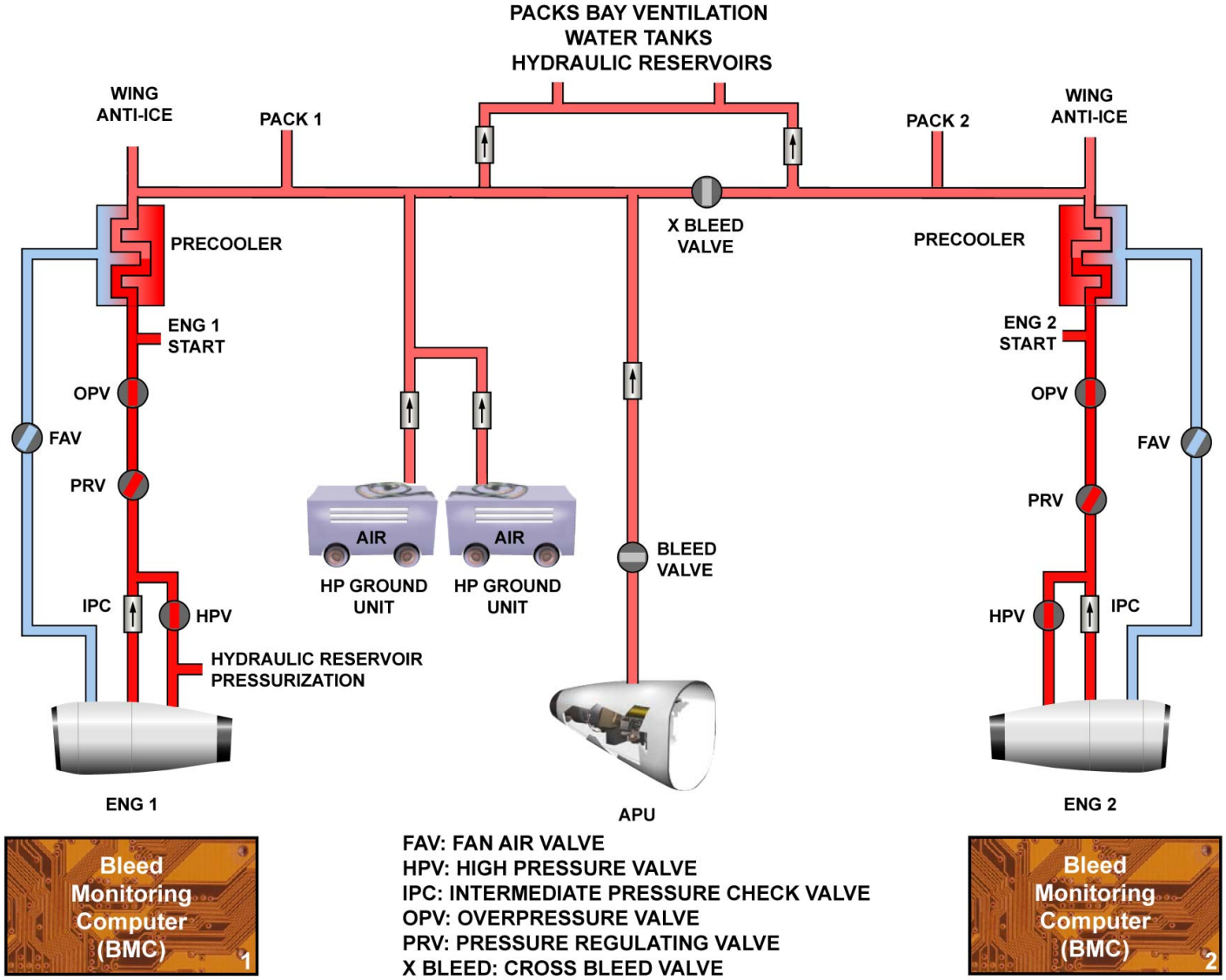

SYSTEM OVERVIEW - SOURCES AND USERS ... APU BLEED/EXTERNAL AIR SUPPLY

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PNEUMATIC LINE MAINTENANCE BRIEFING (2)

SYSTEM OVERVIEW (continued)

LEAK DETECTION

Leak detection elements, connected in series, are installed along the hot air supply ducts of the pneumatic system and are monitored by the BMCs. A dual loop detection system is installed in the wings, the mid fuselage and in the air conditioning compartment to monitor the packs and bleed ducts. The APU supply duct is also monitored by a dual-loop system. The loops are made of multiple sensing elements connected in series. Two loops (A and B) are routed in parallel along the air ducts. The BMC uses "AND" logic to generate a leak warning and to prevent spurious warnings.
In each engine pylon, a single detection loop is monitored for leaks by the respective BMC.

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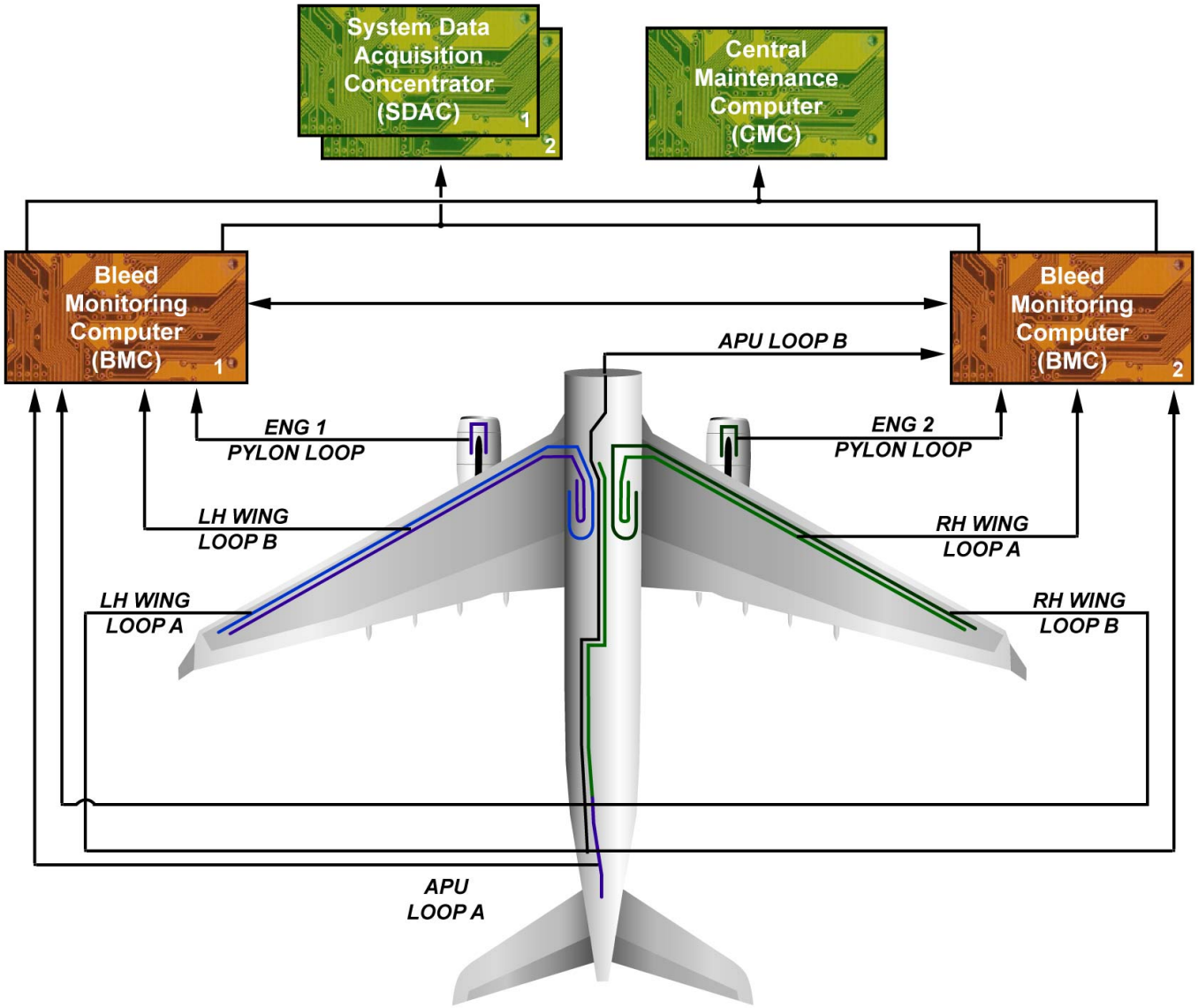
System Data Acquisition Concentrator (SDAC) 1 2
Central Maintenance Computer (CMC)
Bleed Monitoring Computer (BMC) 1
Bleed Monitoring Computer (BMC) 2
APU LOOP B
ENG 1 PYLON LOOP
ENG 2 PYLON LOOP
LH WING LOOP B
RH WING LOOP A
LH WING LOOP A
RH WING LOOP B
APU LOOP A

SYSTEM OVERVIEW - LEAK DETECTION

PNEUMATIC LINE MAINTENANCE BRIEFING (2)

MEL/DEACTIVATION

The aircraft may be dispatched with one of the engine bleed valves PRV deactivated, referring to the MEL. The conditions for dispatch require the valve to be locked in the closed position and the related engine bleed system is inoperative.
Procedure to lock the valve closed:
- open the LH fan cowl
- make the thrust reverser unserviceable and open the LH thrust reverser cowl door
- on the PRV, remove the locking pin from its stowage
- on the manual override, make sure that the valve is in the CLOSED position and install the locking pin to secure the valve closed

The aircraft may also be dispatched with one of the engine HPV deactivated, referring to the MEL. The conditions for dispatch require the valve to be locked in the closed position. In addition, the related engine bleed system should not be used at low power setting.
Procedure to lock the valve closed:
- open the LH fan cowl,
- make the thrust reverser unserviceable and open the LH thrust reverser cowl door,
- on the HPV, remove the locking pin from its stowage,
- on the manual override, make sure that the valve is in the CLOSED position and install the locking pin to secure the valve closed.

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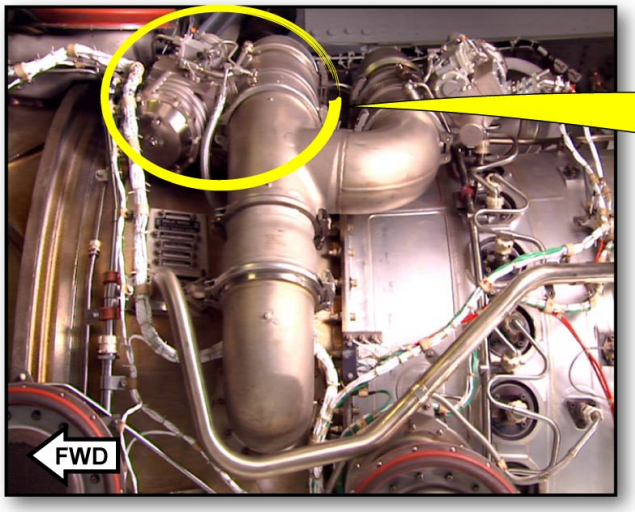
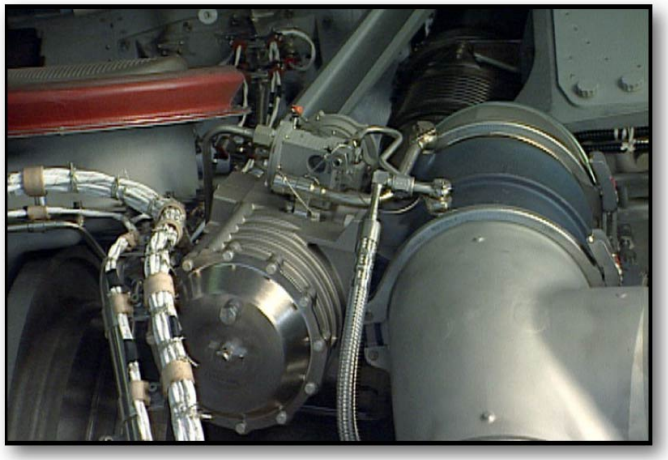
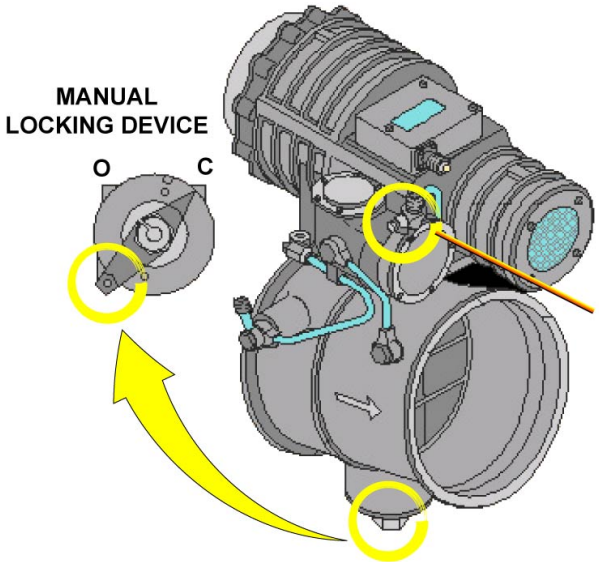




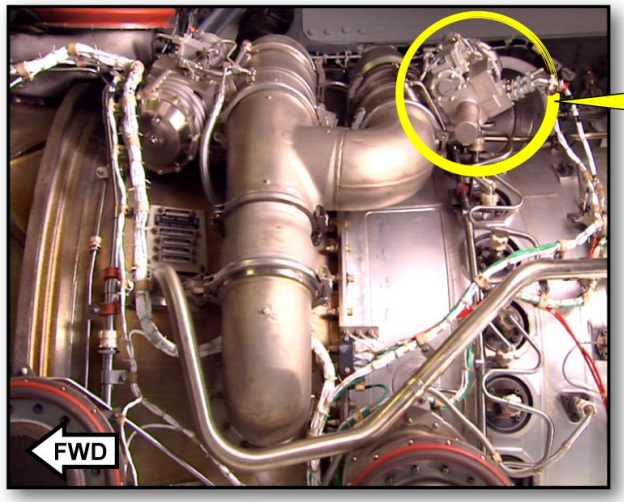
PRESSURE REGULATING VALVE (PRV)

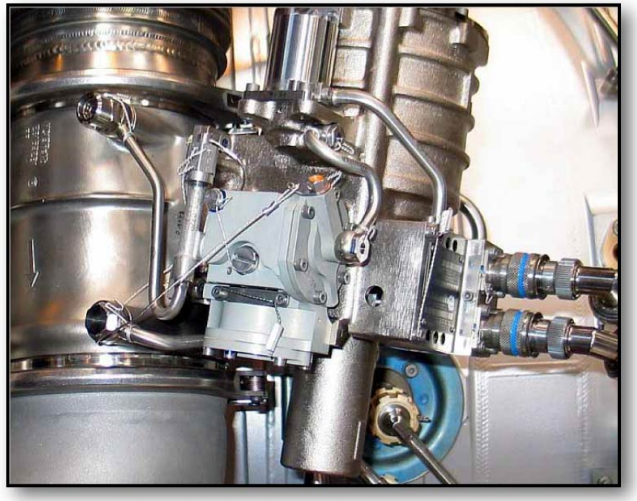


11-02 Bleed Valve	C	2	1	(m) One may be inoperative provided : 1) It is secured closed, and 2) The associated engine bleed air supply system is considered inoperative. Refer to 36-11-01

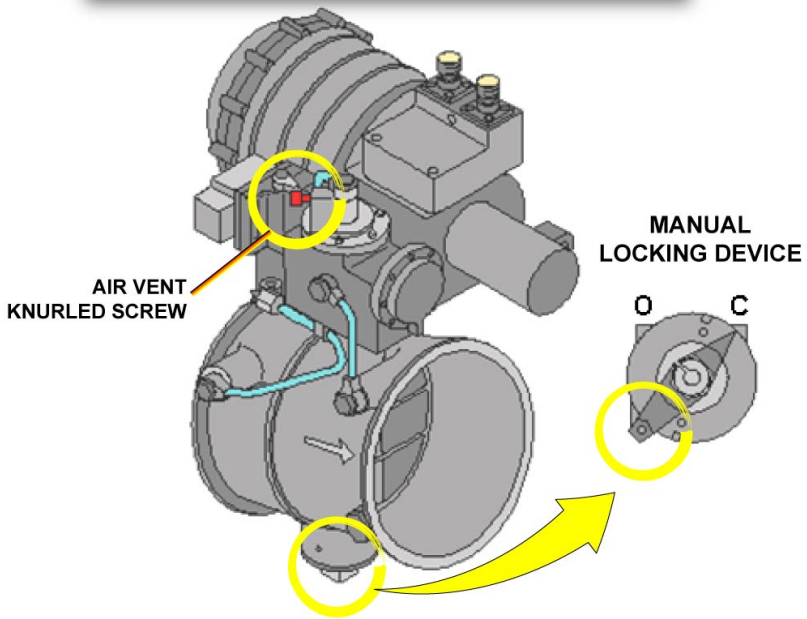
MEL

MEL/DEACTIVATION





HIGH PRESSURE VALVE (HPV)



11-07 HP Valve	C	2	1		a) One may be inoperative in closed position provided the associated engine bleed air supply system is considered inoperative. Refer to 36-11-01
					- or -
	C	2	1	(o)(m)	b) One may be inoperative provided: 1) It is deactivated and secured in closed position, and 2) At low power setting the associated engine bleed air supply system is not used.

MEL

MEL/DEACTIVATION

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PNEUMATIC LINE MAINTENANCE BRIEFING (2)

MAINTENANCE TIPS

Troubleshooting Note:
The condition of an overheat detection loop is checked by measurement of its Insulation Resistance (I/R), as detailed in the related TSM task 36-22-00-810-xxx):
- For the wings and APU loops, the I/R must be above 6 K
- For engines pylon loops, the I/R must be above 25 K

NOTE: I/R measurement must be done using an Alternate Current (AC) loop controller (Example: 9240SI). The use of Direct Current (DC) loop controller will impact the electrical characteristics of the sensing element.

A test set is available to help in troubleshooting of the pneumatic system. It is used to do an on-wing operational test of the HPV, PRV, FAV, OPV and pressure transducers.
If the ENG BLEED LEAK warning is displayed on the ECAM, there is the possibility of a high-pressure air leak on the engine pneumatic ducts. The leak may be found by using the (aluminum) foil-wrapping procedure to locate the source. This procedure is also used to check for leaks after installation of a bleed valve or a duct.
Procedure:
- wrap the foil around the joint one time,
- twist the seam of the foil wrap tight,
- secure the foil wrap on either side of the joint with lockwire,
- run the engine,
- after shutdown, check for any evidence of leaks.

NOTE: The leak may also be found by using the alternative procedure with the use of the dry developer.

The GND indication on the ECAM BLEED page sometimes causes confusion. It does not indicate that external pneumatic supply is connected or even that the access door is open. GND appears on the BLEED page when the aircraft is on the ground to indicate that the external pneumatic supply will be connected directly to the left hand side of the system. The only indication that external ground air is supplied is indication of system pressure on the left hand side. To make an engine start with ground air, the connection is located on the lower fuselage. The access door is on the belly fairing.
During a ground air start, the crossbleed valve must be manually operated. For safety, it is recommended to use the ground air supply to start the first engine. Then disconnect the ground air supply and make a crossbleed start for subsequent starts.
The installation of PTFE (Teflon) seals on the bleed air duct is done in two steps. First the installation of the filler ring inside the bleed duct groove and then the installation of the seal with its green face visible from outside.

NOTE: No lubricant has to be applied prior and/or during installation of PTFE seal.

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NOTE:

I/R MEASUREMENT MUST BE DONE USING AC METER ONLY THE USE OF DC METER WILL IMPACT SENSING ELEMENTS ELECTRICAL CHARACTERISTICS.

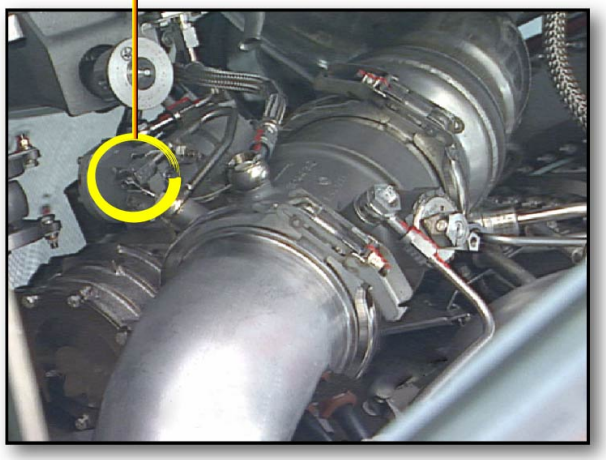
Overheat Detection Loops Insulation Resistance (I/R) check:

Wings & APU Loops:
- I/R must be > 6 KOhms
Engines Pylon Loop:
- I/R must be > 25 KOhms

MAINTENANCE TIPS

BLEED TEST SET

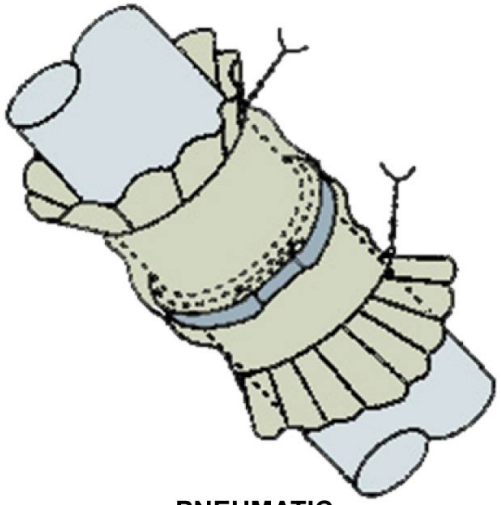
TEST INTAKE



PRV (ON WING)
FUNCTIONAL TEST

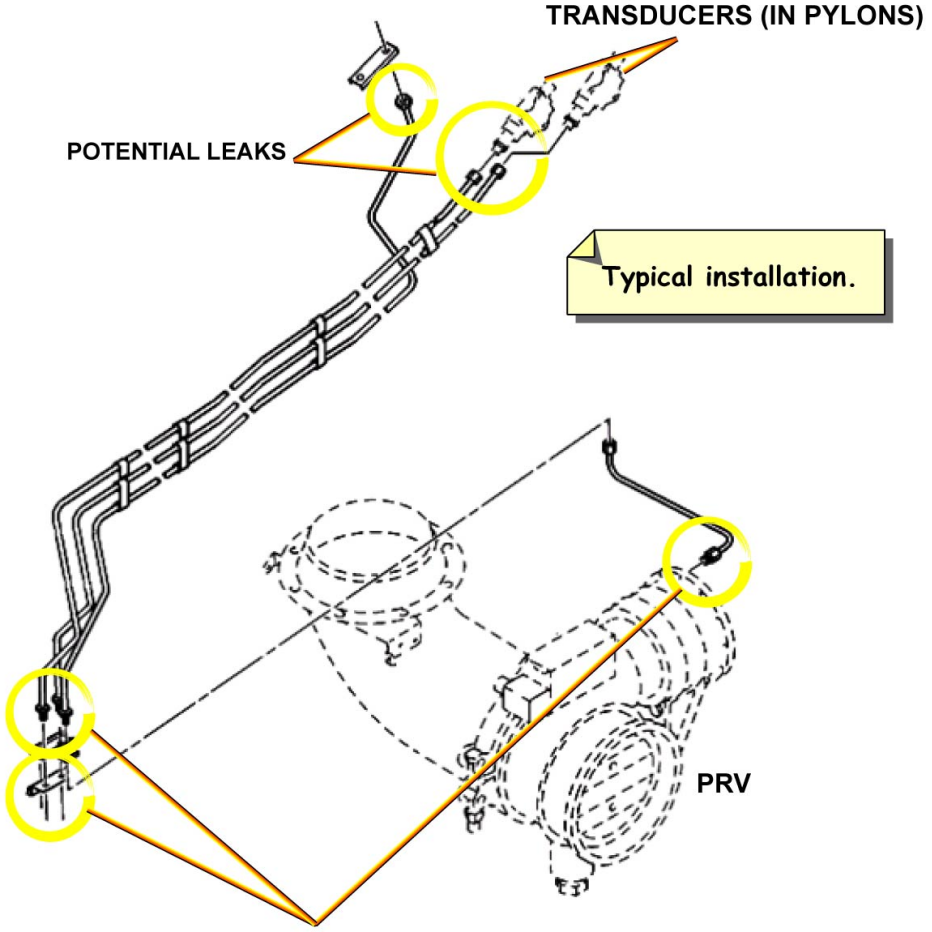
MAINTENANCE TIPS

TWIST LOCKWIRE TO MAKE FOIL
WRAP TIGHT ON DUCT AT BOTH ENDS

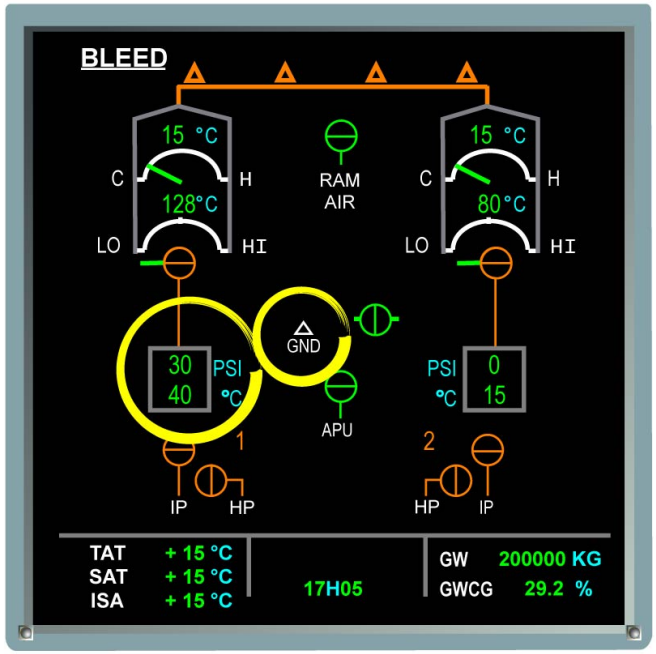


PNEUMATIC
DUCT

ENGINE/WARNING DISPLAY (EWD)

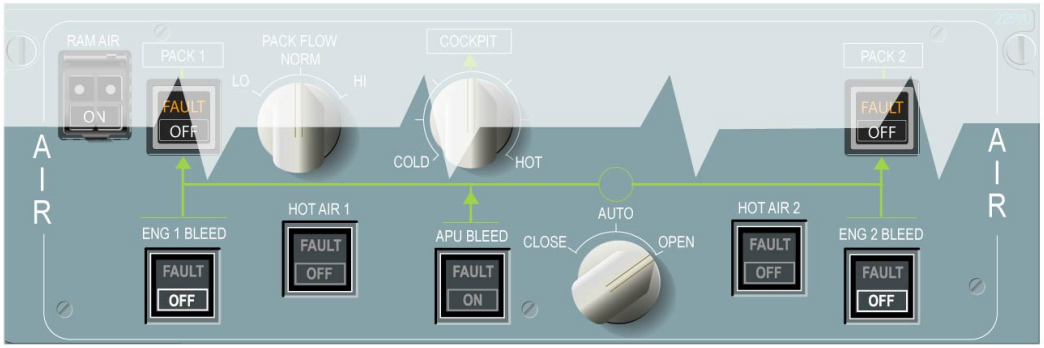


MAINTENANCE TIPS

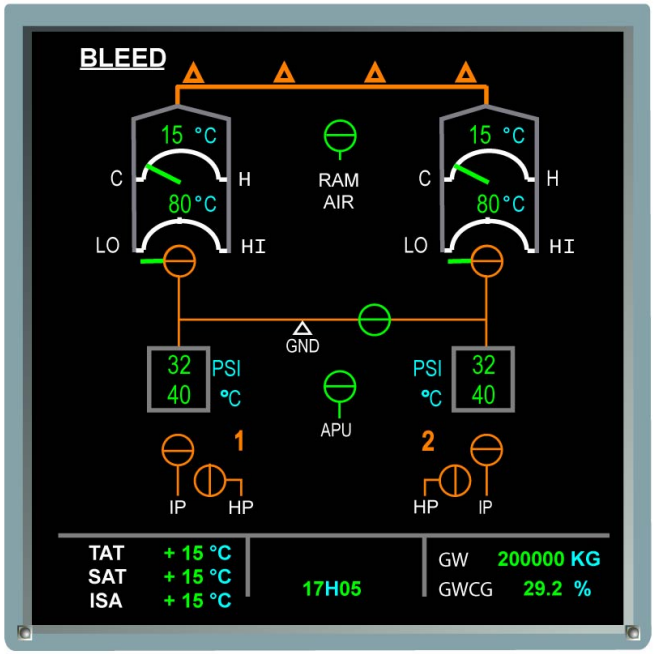


ECAM SYSTEM DISPLAY (SD)

MAINTENANCE TIPS



Preparation for ENGINE START with external pneumatic power.



ECAM SYSTEM DISPLAY (SD)

MAINTENANCE TIPS

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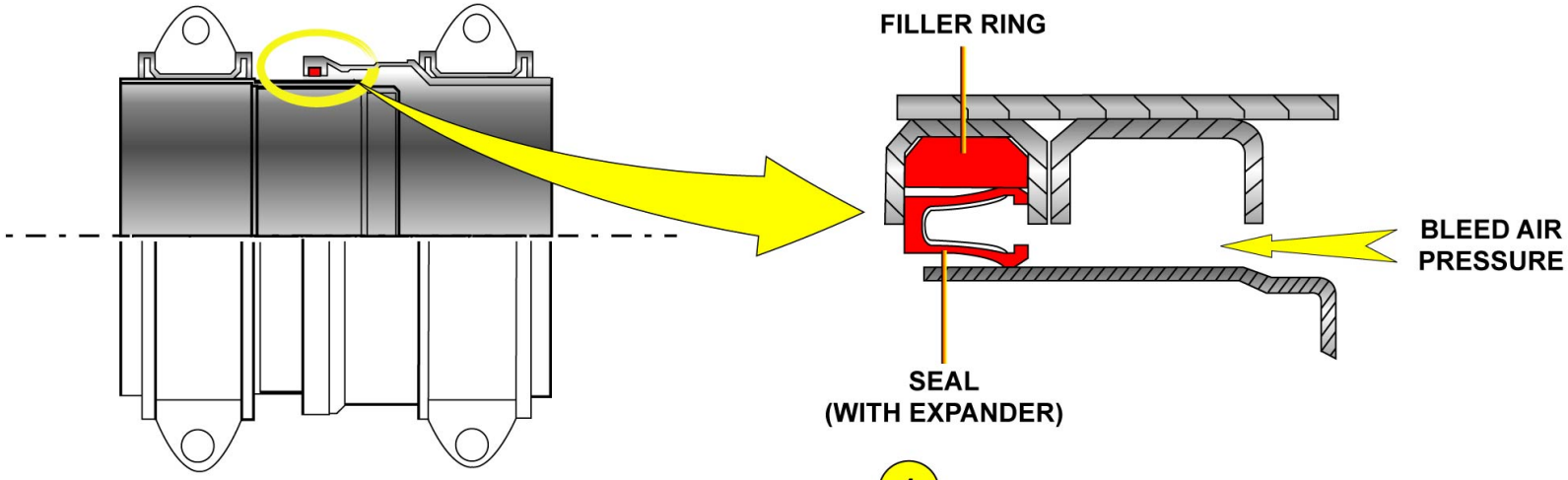
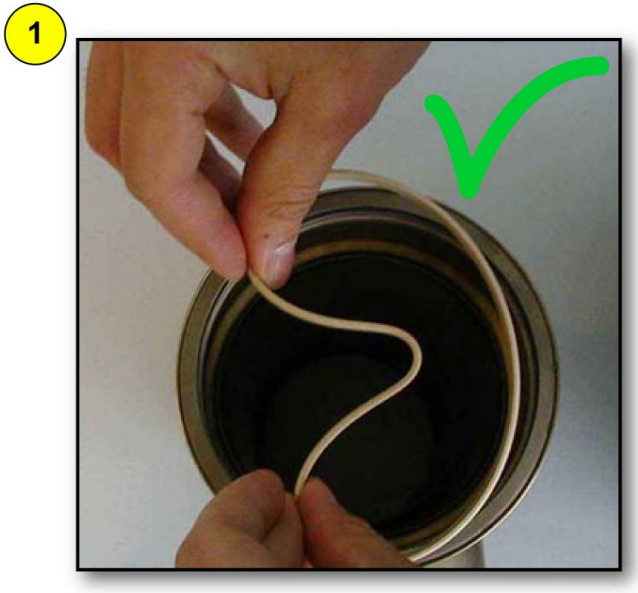
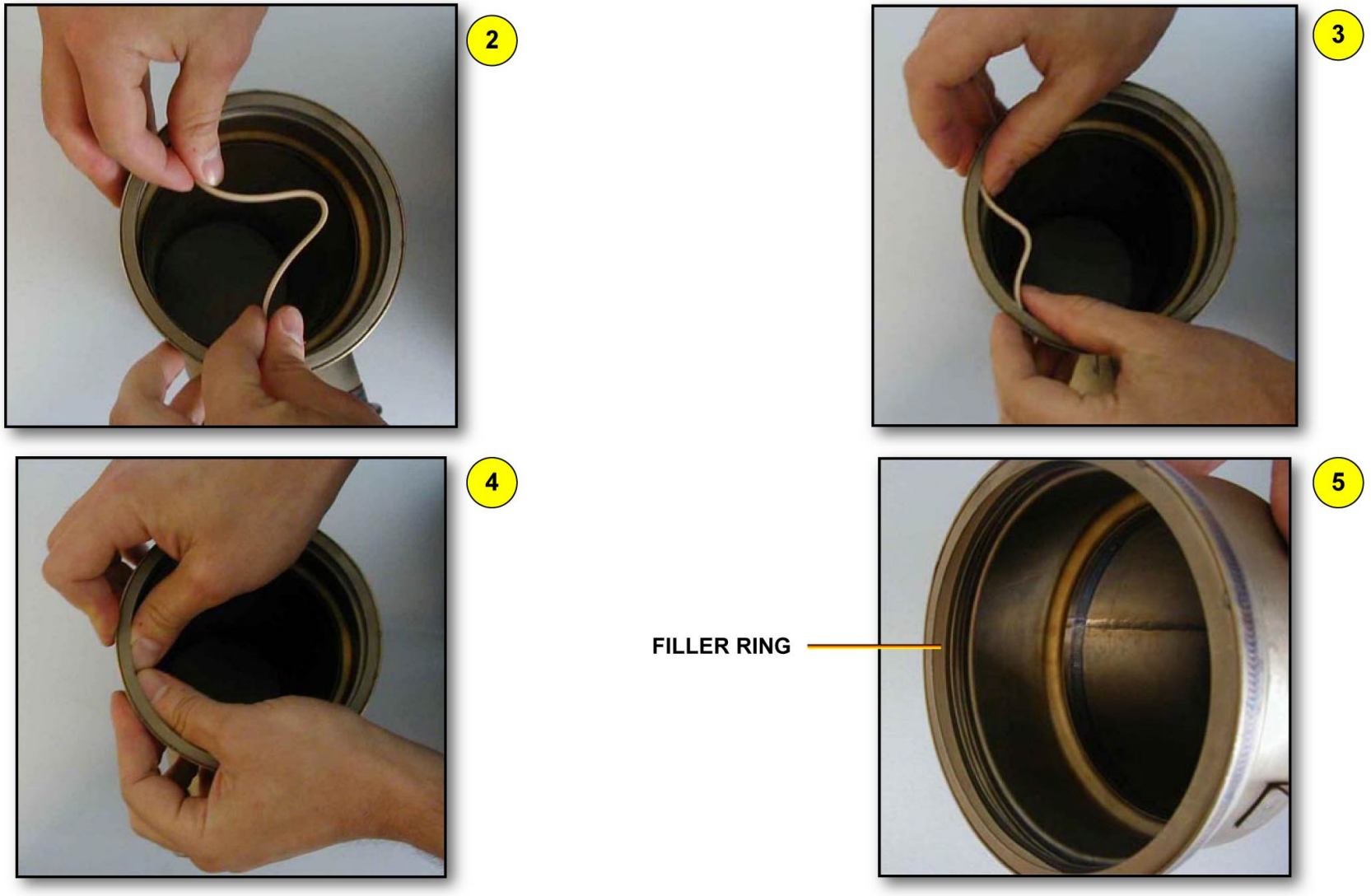
INSTALLATION OF THE FILLER RING





MAINTENANCE TIPS

INSTALLATION OF THE FILLER RING

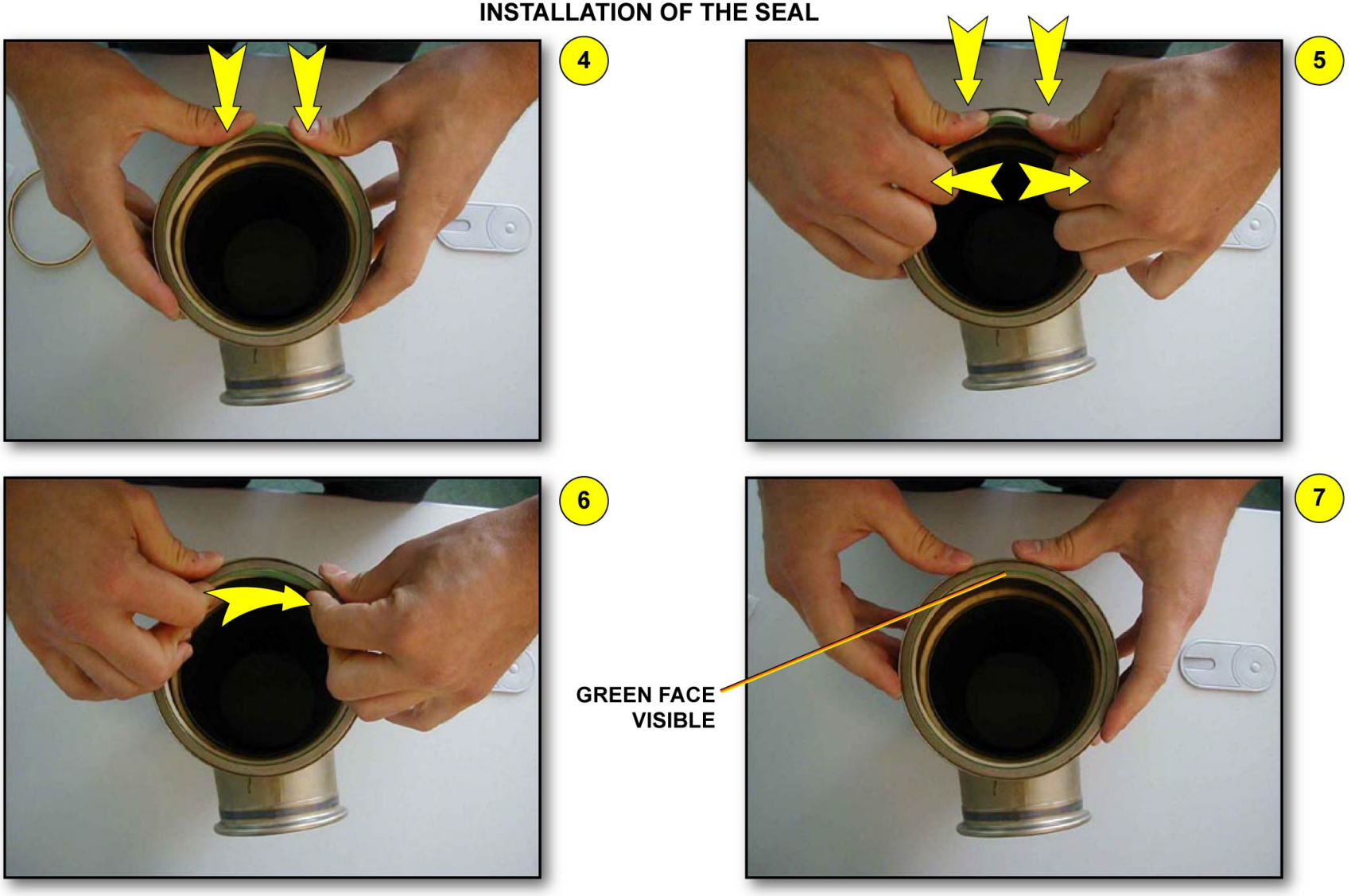


MAINTENANCE TIPS

INSTALLATION OF THE SEAL

MAINTENANCE TIPS

INSTALLATION OF THE SEAL



MAINTENANCE TIPS

BLEED AIR DISTRIBUTION & SUPPLY D/O (3)

GENERAL

The crossbleed valve connects or disconnects the LH and the RH pneumatic manifolds. High Pressure (HP) ground connectors can supply air to the LH pneumatic manifold and through the crossbleed valve to the RH pneumatic manifold when connected to a ground cart. The APU can supply air to the LH and RH pneumatic manifolds on ground and during climb up to 23000 feet (7010 meters) and during the descent from 21000 feet (6400 meters). The engine bleed air systems are connected to the corresponding pneumatic manifold.

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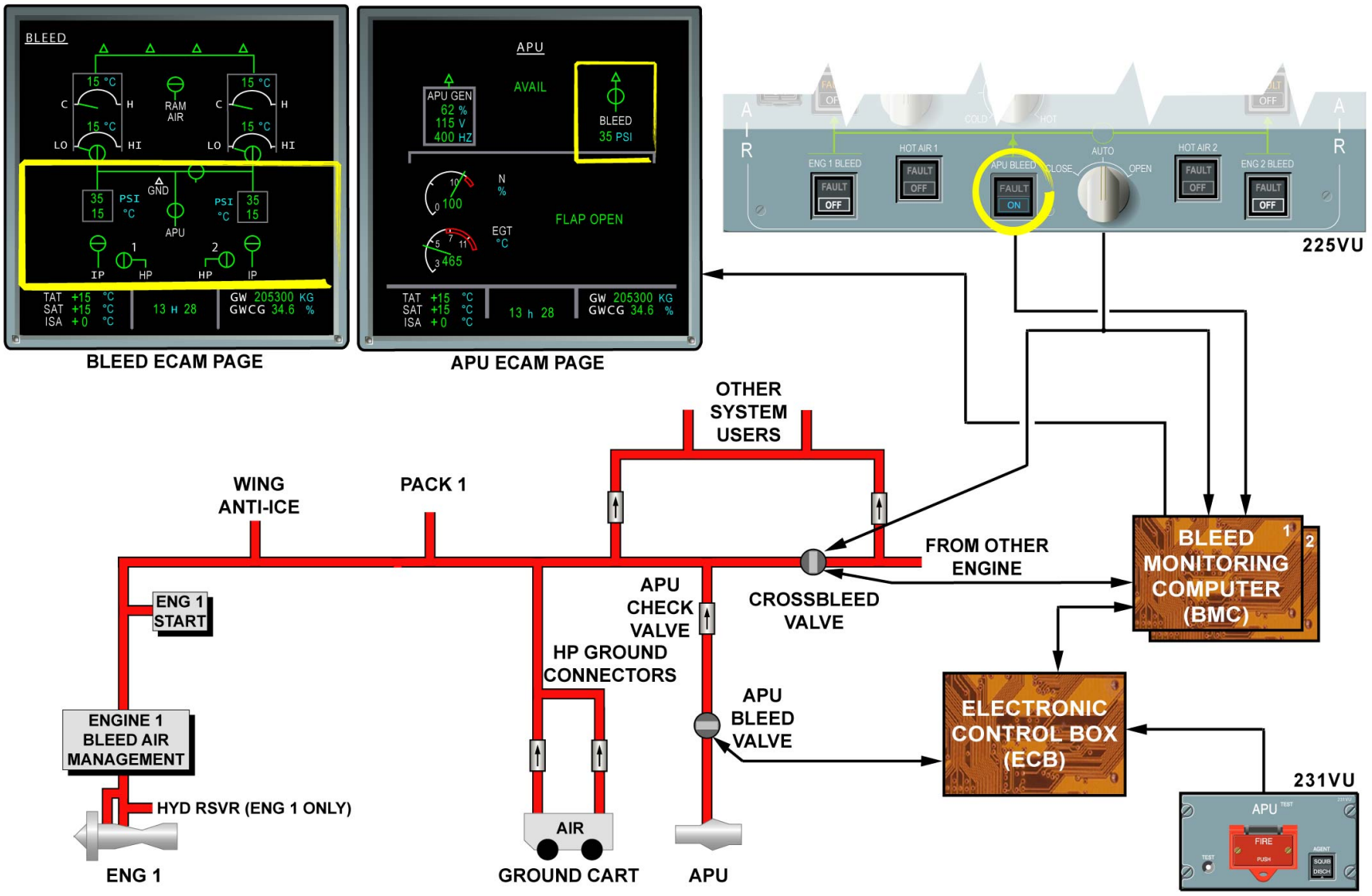

BLEED
15 °C
RAM AIR
LO
HI
35 PSI °C 15
GND
APU
IP
HP
TAT +15 °C
SAT +15 °C
ISA +0 °C
13 H 28
GW 205300 KG
GWCG 34.6 %
BLEED ECAM PAGE
APU
APU GEN
62 %
115 V
400 HZ
AVAIL
BLEED
35 PSI
N %
EGT °C
FLAP OPEN
APU ECAM PAGE
ENG 1 BLEED
HOT AIR 1
APU BLEED
CLOSE
AUTO
OPEN
HOT AIR 2
ENG 2 BLEED
FAULT
OFF
ON
225VU
OTHER SYSTEM USERS
WING ANTI-ICE
PACK 1
FROM OTHER ENGINE
BLEED MONITORING COMPUTER (BMC)
ENG 1 START
APU CHECK VALVE
HP GROUND CONNECTORS
CROSSBLEED VALVE
ENGINE 1 BLEED AIR MANAGEMENT
APU BLEED VALVE
ELECTRONIC CONTROL BOX (ECB)
231VU
HYD RSVR (ENG 1 ONLY)
AIR
ENG 1
GROUND CART
APU

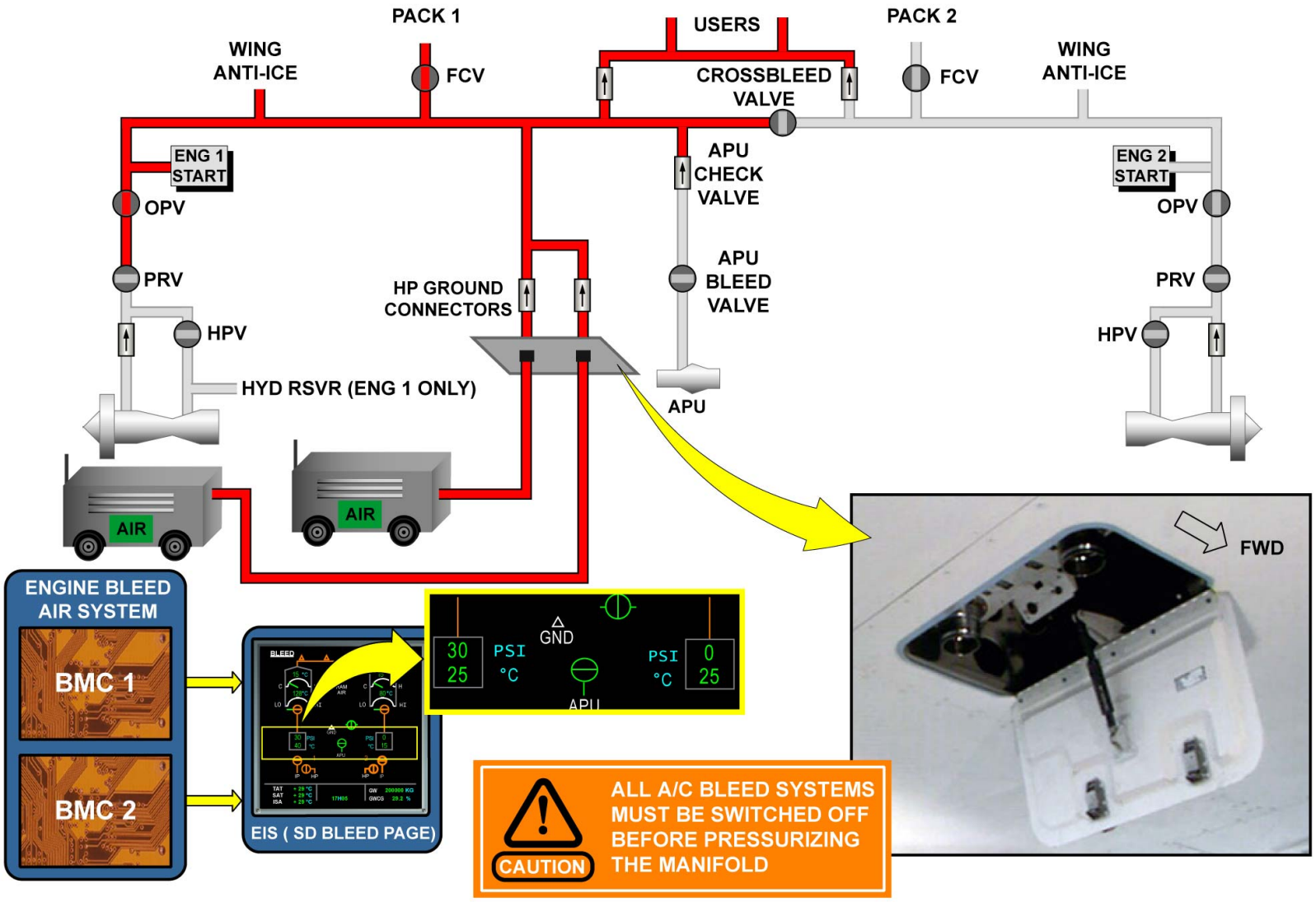
GENERAL

BLEED AIR DISTRIBUTION & SUPPLY D/O (3)

HP AIR GROUND SUPPLY

The ground air source supplies air through the two HP ground connectors installed at the bottom left of the belly fairing. Each connector contains a non-return valve and a built-in nipple. A short duct connects the HP ground connectors to the crossbleed manifold, to the left of the crossbleed valve. Once connected and switched ON, ground cart delivered pressure can be checked on the ECAM BLEED page. This pressure indication is given through the engine bleed system.

CAUTION: all A/C bleed systems must be switched off before the crossbleed manifold is pressurized by the ground cart.



HP AIR GROUND SUPPLY

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BLEED AIR DISTRIBUTION & SUPPLY D/O (3)

APU BLEED AIR SUPPLY

The main components of the APU bleed system are the APU bleed valve and the APU check valve.

APU BLEED AND CHECK VALVES

The APU bleed valve is an ON/OFF butterfly valve, spring loaded closed, with a visual position indicator installed. It is electrically controlled by a solenoid and pneumatically operated. Its muscle pressure is tapped upstream of the valve. A Fully Closed (FC)/NOT FC micro switch is installed on the valve for indicating and monitoring purposes. The check valve protects the APU from reverse flow when another source supplies bleed air at a higher pressure.

APU BLEED VALVE CONTROL

Once the APU BLEED P/B is set to ON, a ground signal is sent to both Bleed Monitoring Computers (BMCs). Then, the BMCs send an opening command to the Electronic Control Box (ECB) if the following conditions are met:
- the APU master switch is ON,
- the APU BLEED P/B is ON,
- no leak is detected on the APU bleed duct,
- and no leak is detected on the LH pneumatic manifold.

Note that these two leak conditions are not active during Main Engine Start (MES).

Once the ECB receives the opening command, it energizes the bleed valve solenoid only if:
- the APU runs at more than 95% of speed,
- no APU shutdown is carried out,
- and the altitude is lower than 23000 feet (7010 meters)during climb or 21000 feet (6400meters) during descent.

As a consequence, the APU bleed valve opens, the Pressure Regulating Valves (PRVs) of the two engines automatically close and the crossbleed valve automatically opens when the APU supplies bleed air to the users. APU bleed valve position and bleed pressure are indicated on the ECAM BLEED page (the pressure value is given by the engine bleed system).

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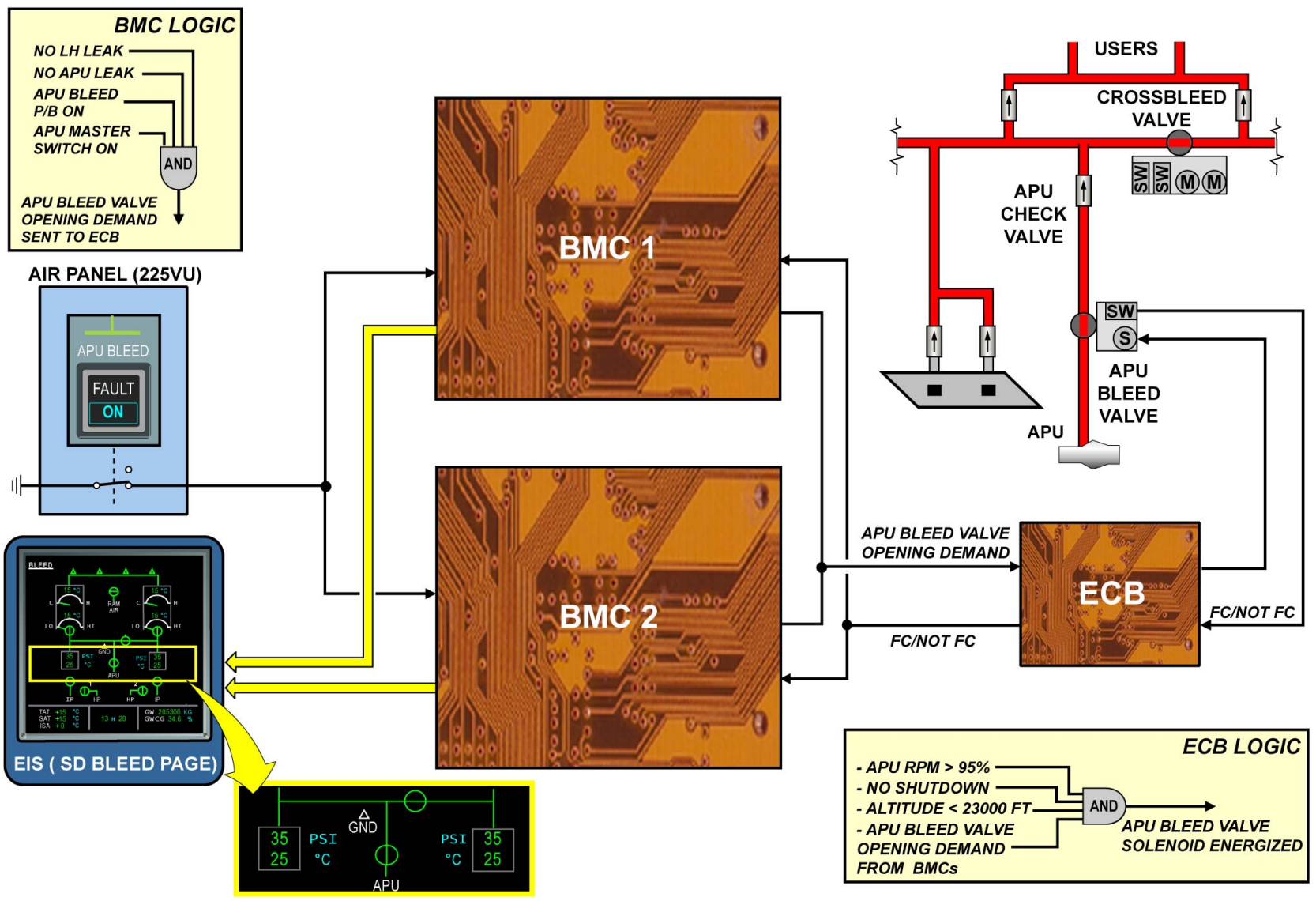

APU BLEED AIR SUPPLY - APU BLEED AND CHECK VALVES & APU BLEED VALVE CONTROL

G9409341 - GAUT0T0 - FM36D1000000003

BLEED AIR DISTRIBUTION & SUPPLY D/O (3)

CROSSBLEED SYSTEM

The crossbleed valve is an electrically controlled butterfly shut-off valve. Two electrical motors, which work independently, are used for manual or automatic operation. A Fully Open (FO) or Fully Close (FC) position of the valve is sent to the two BMCs by 2 micro switches. Either automatic or manual control can be selected using the crossbleed valve selector of the AIR panel.

AUTOMATIC CONTROL

When the crossbleed valve selector is in the AUTO position, the crossbleed valve control is carried out by the BMCs, through the primary valve motor. As soon as:
- the APU BLEED P/B is ON,
- the APU bleed valve is not FC,
- and there is no leak detected,

the BMCs send a ground signal to the crossbleed valve auto-control relay.
As a consequence, the crossbleed valve auto-control relay supplies electrical power to the crossbleed valve primary motor and the crossbleed valve opens. The FO position feedback from the microswitch is indicated on the ECAM BLEED page through the BMCs. When the APU BLEED is deselected, the APU bleed valve closes and, in turn, the crossbleed valve closes.
The FC feedback from the second microswitch is displayed on the BLEED page.

MANUAL CONTROL

The manual opening control can be used in the subsequent cases:
- cross supply by a ground cart,
- crossbleed engine start,
- or when an engine bleed system fails.

As soon as a manual control is selected, the crossbleed valve primary motor power supply is cut out. When the crossbleed valve selector switch is set to OPEN, it directly supplies the secondary crossbleed valve motor, which opens the valve. When the crossbleed valve selector switch is set to CLOSE, the secondary motor closes the crossbleed valve. As in the automatic mode, the valve position is given by the 2 microswitches and shown on the ECAM BLEED page.

INCORRECT OPERATION

If a disagreement between the valve position and command occurs, the BMCs trigger an ECAM message and the BLEED page comes up automatically.

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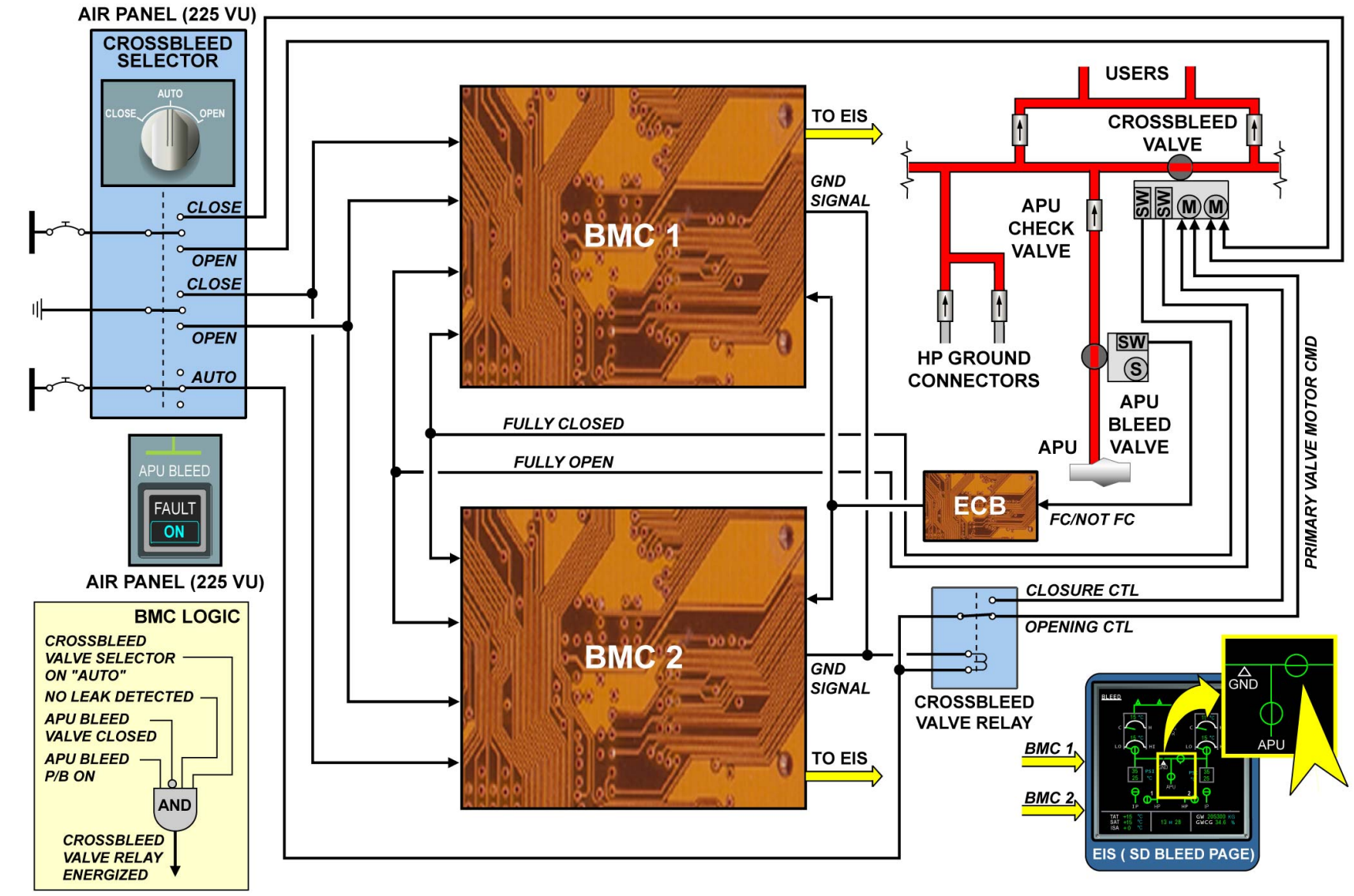


CROSSBLEED SYSTEM - AUTOMATIC CONTROL ... INCORRECT OPERATION

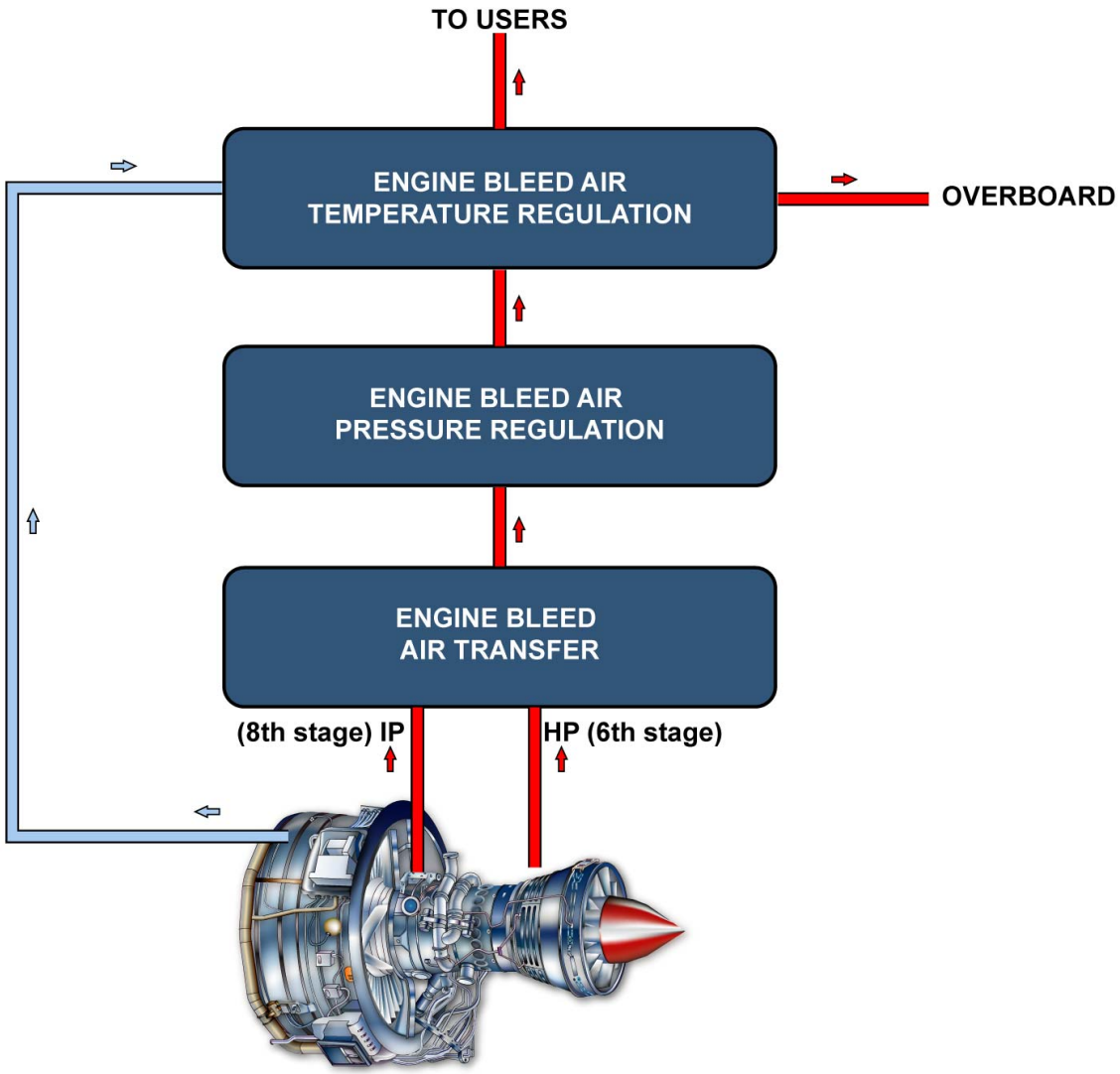
G9409341 - GAUT0T0 - FM36D1000000003

ENGINE BLEED AIR MANAGEMENT SYSTEM GENERAL. D/O (3)

GENERAL

The main air bleed sources are the engines. Air can be bled from two different stages. It is generally bled from an Intermediate Pressure (IP) stage of the IP compressor stage 8 to minimize fuel penalty. When pressure from the IP bleed port is insufficient to supply the network, air is automatically bled from the High Pressure (HP) compressor stage 6.
Each engine bleed air system includes the following sub-system:
- pneumatic transfer system. It selects one of the two compressor of the engine IP or HP compressor in agreement with the supplied pressure,
- pressure limitation system to regulate the bleed air pressure in order to prevent overpressure,
- temperature limitation system to regulate the bleed air temperature in order to prevent over temperature.

G9409341 - GAUT0T0 - FM36D6000000003


TO USERS
ENGINE BLEED AIR
TEMPERATURE REGULATION
OVERBOARD
ENGINE BLEED AIR
PRESSURE REGULATION
ENGINE BLEED
AIR TRANSFER
(8th stage) IP
HP (6th stage)

GENERAL

ENGINE BLEED AIR MANAGEMENT SYSTEM GENERAL. D/O (3)

BLEED AIR TRANSFER

The transfer from one bleed port to another is carried out using a HP bleed Valve (HPV) at the HP stage. The transfer depends on the available pressure and engine speeds. In the normal engine bleed air configuration, the air is bled from the IP port at high engine speed. At low engine speed, especially during A/C descent with engines at idle, the IP port pressure is insufficient and the air is automatically bled from the HP port.
Transfer to the IP stage can be forced by closing the HPV via a solenoid incorporated in the HPV. This transfer is commanded by the Electronic Engine Controller (EEC) of the related engine. The HPV can also be closed by action on the engine BLEED P/Bs
A check valve located on the IP bleed port avoids reverse flow when air is bled from the HP stage.

PRESSURE LIMITATION

Air is then sent through the engine bleed air pressure regulation system first composed of a Pressure Regulating Valve (PRV) associated to a thermostat solenoid. The valve acts as a shut-off and PRV. The PRV is fully and pneumatically operated and controlled by the thermostat solenoid. The shut-off function of the PRV through the thermostat solenoid is controlled by the corresponding BMC or by using the ENG BLEED P/Bs located on the AIR panel or the engine FIRE P/B.
A fully pneumatic Overpressure Valve (OPV) protects the system against overpressure.

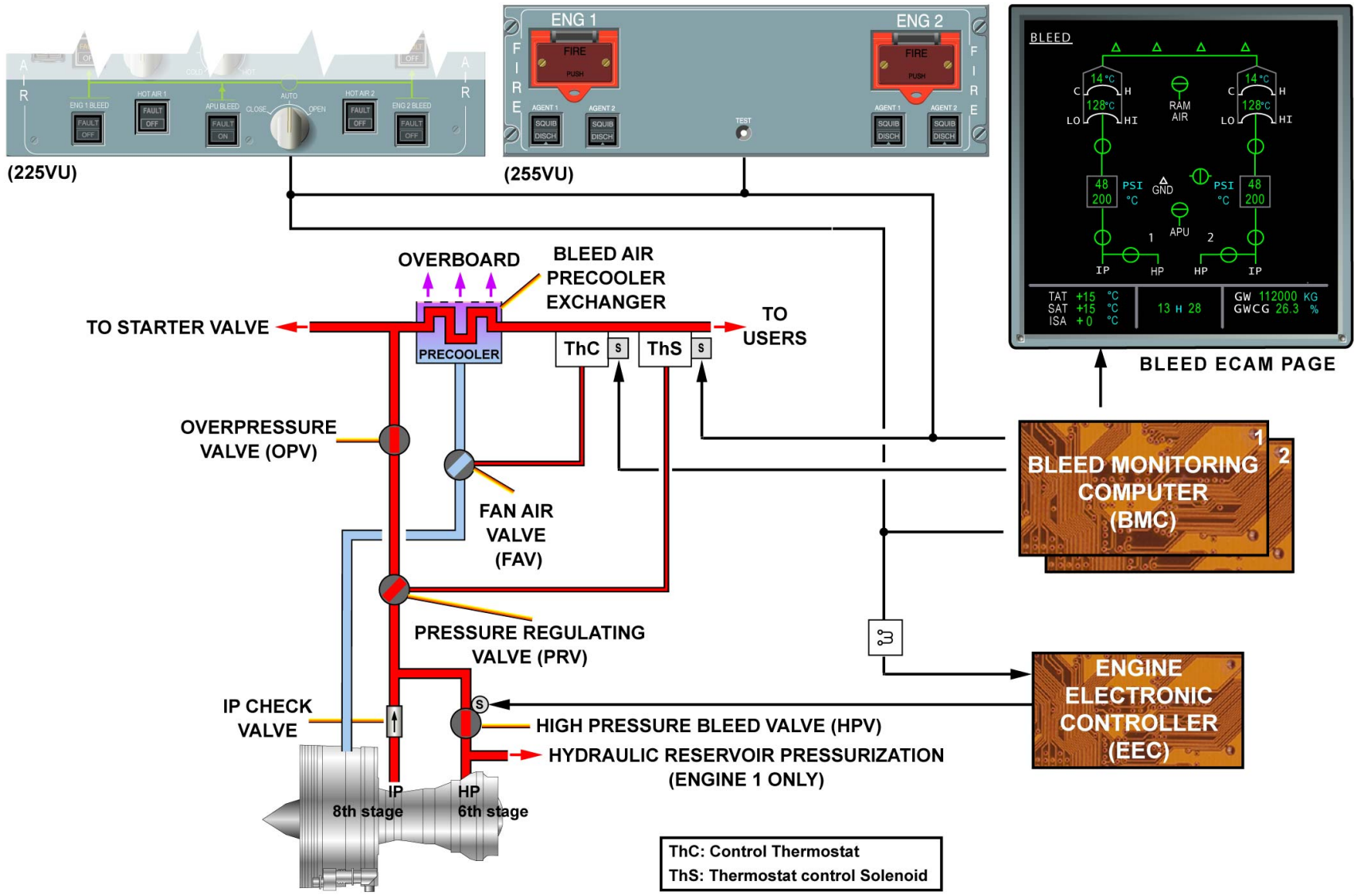
TEMPERATURE LIMITATION

The temperature regulation of the bleed air system is carried out by a Fan Air Valve (FAV), which modulates fan airflow through an air-to-air heat exchanger. The FAV is controlled by the BMC through the Control Thermostat (ThC). The temperature regulation gives two temperature settings: 200°C for nominal conditions (solenoid not energized) and 150°C on demand from the air conditioning system if the wing anti-ice system is not operative (solenoid energized).
Finally, bleed air is ducted to the bleed air distribution and supply network.

MONITORING

The position of the valves, bleed air temperature and pressure are indicated on the ECAM bleed page.

G9409341 - GAUT0T0 - FM36D6000000003



BLEED AIR TRANSFER ... MONITORING

G9409341 - GAUT0T0 - FM36D600000003

ENGINE BLEED AIR TRANSFER SYSTEM D/O (3)

DESCRIPTION

The selection of the High Pressure (HP) compressor stage source on each engine is carried out through a HP bleed Valve (HPV) and an Intermediate Pressure (IP) check valve.

HIGH PRESSURE BLEED VALVE

The HPV is pneumatically operated for pressure limitation and safety. It is a spring-loaded closed shut-off valve. The HPV is electrically controlled to close by a double coil solenoid.
The minimum operating pressure of the valve is 12 psi and it pneumatically regulates the pressure around 40 psi.
It has a Fully Closed (FC)/NOT FC microswitch for monitoring and indicating.
For maintenance purposes, the HPV has a ground test port, a mechanical position indicator and a threaded hole which lets the butterfly locked in the closed position.

IP CHECK VALVE

The IP check valve is a non-return valve which closes automatically to prevent HP air from re-circulating toward the IP stage when the HPV is open.

BLEED TRANSFERRED PRESSURE TRANSDUCER

The bleed transferred pressure transducer is installed on a bracket in the engine pylon. Its pressure sense line tapping is taken downstream of the HPV.

PRESSURE TRANSFER SYSTEM

It enables the selection of engine compressor bleed air stage. It includes two mains components: High Pressure Valve (HPV) and IPC valve.
Air is bled by the IPC or HPV depending on the available pressure and engine speeds as follows:

- Normal configuration, at high engine speed air is bled from the IPC 8th stage through the IPC valves.
- When engines at idle or during descent, at low engine speed, the IP pressure is insufficient. Air is automatically bled from the HPC 6th stage through the HP valve. The downstream pressure causes the IPC valve to close.

Closing signal from:
- EEC (engine parameters)
- BMC (bleed systems data) through relay
- ENG BLEED P/B through relay

NORMAL OPERATION

The IP/HP bleed transfer control is pneumatically achieved. When the IP stage pressure exceeds the HPV target value of an average of 40 psi, the HPV closes and air bleed is supplied by the IP stage, via the IPC.
The HPV is electrically controlled to close its solenoid by the Engine Electronic Controller (EEC) following:
- an EECl logic,
- a Bleed Monitoring Computer (BMC) demand via a relay,
- by action on the ENG BLEED P/B via a relay,
- by action on the ENG FIRE P/B via a relay.

The HPV position is shown on the SD BLEED page.

ABNORMAL HIGH PRESSURE BLEED VALVE CLOSURE

An abnormal BMC closure function is used for system protection purposes or during specific operations. The BMC sends a HPV closing command to the EEC via a relay. This HPV closing command is sent any time when the Pressure Regulating Valve (PRV) is commanded closed.
The HPV also closes when the HP pressure is higher than 85 psi, the Wing Anti Ice (WAI) is not selected and the altitude is higher than 26000 feet (7925 meters), or when the compressor exit temperature is higher than 430 degrees Celsius and the HP pressure higher than 75 psi.

If the IP/HP transfer fails, the HPV pneumatically closes when the upstream pressure is higher than 185 psi.

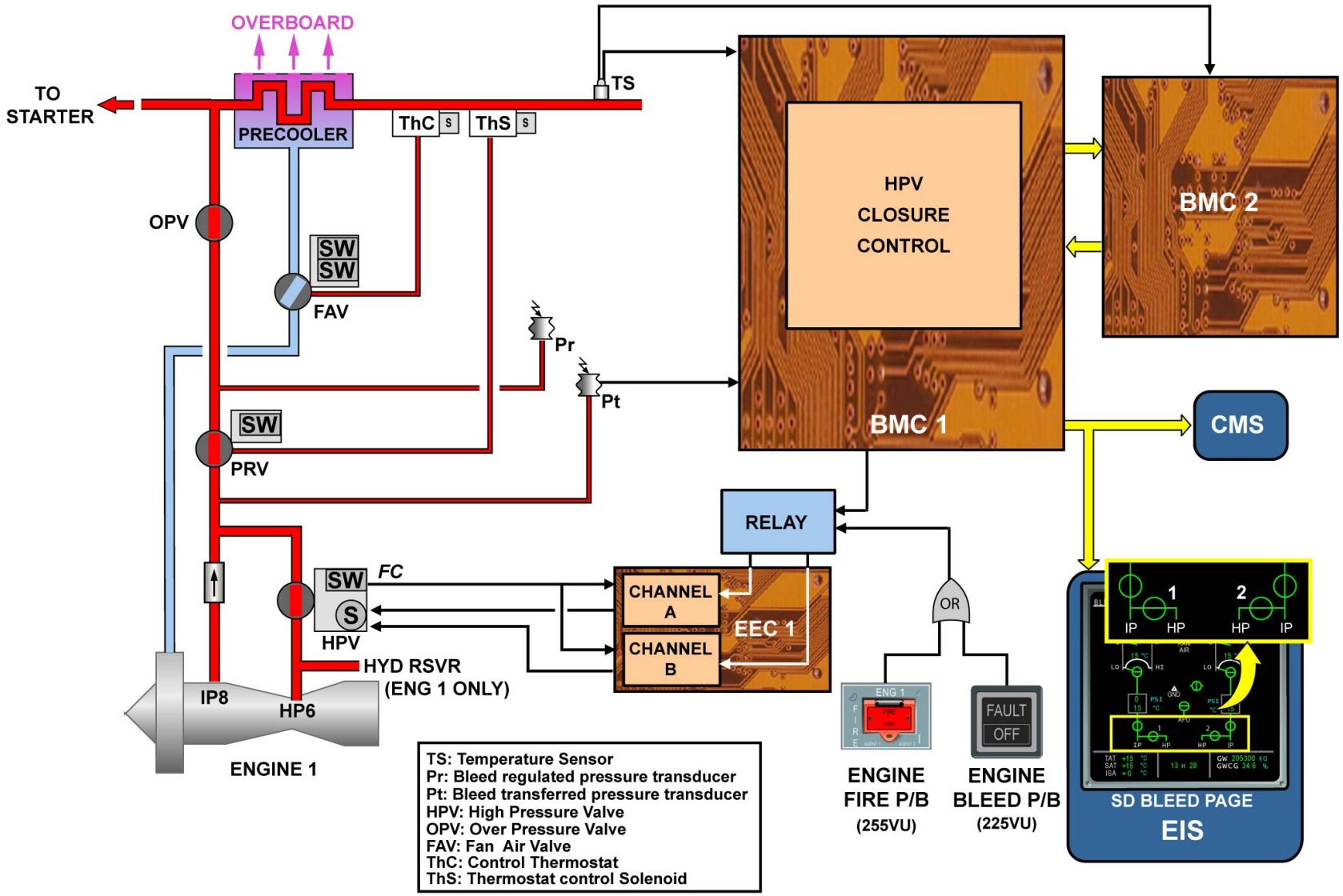
VALVE POSITION DISAGREEMENT

When the HPV is controlled open and is detected in the closed position, the BMC triggers an ECAM message and the BLEED page comes up automatically.

MONITORING

The bleed transferred pressure transducer is used for system monitoring and fault isolation regarding the PRV and HPV. An associated fault message is sent to the Central Maintenance System (CMS) for maintenance purposes.

G9409341 - GAUT0T0 - FM36D2000000006



DESCRIPTION ... MONITORING

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G9409341 - GAUT0T0 - FM36D2000000006

ENGINE BLEED AIR PRESSURE REGULATION SYSTEM D/O (3)

SYSTEM DESCRIPTION

The pressure regulating system is composed of several components:
- the Pressure Regulating Valve (PRV) associated to a Thermostat control Solenoid (ThS),
- the Over Pressure Valve (OPV),
- the bleed regulated pressure transducer (Pr).

PRESSURE REGULATING VALVE

The function of the PRV is to regulate the engine bleed pressure but it does not ensure pneumatic reverse flow protection. The reverse flow protection is done by the High Pressure bleed Valve (HPV).
The PRV is a butterfly type valve, pneumatically operated and electrically controlled by the ThS.
The PRV operates pneumatically in relation with the associated ThS.
The Ths is connected to the PRV by a pneumatic sense line and is installed in the duct downstream of the precooler exchanger.
The "Fully Closed (FC)/NOT FC" position is sensed by a microswitch used for monitoring and indicating.
The valve has a ground test port and a mechanical position indicator that has a threaded hole. This threaded hole lets the butterfly be locked in the closed position.

OVERPRESSURE VALVE

The OPV protects the downstream pneumatic system if the PRV does not operate correctly (overpressure).
The OPV is a pneumatically actuated valve and is normally open.
Muscle pressure for valve actuation is tapped from an integral pressure port located upstream of the valve.

BLEED REGULATED PRESSURE TRANSDUCER

The bleed regulated pressure transducer is a silicon type transducer, linked by a pressure sense line to a pressure tapping downstream of the PRV. The transducer is connected to both Bleed Monitoring Computers (BMCs) and provides the bleed pressure indication on the BLEED S/D page (ECAM)

PRESSURE REGULATION

The PRV is normally spring-loaded closed in the absence of upstream pressure. A minimum upstream pressure of 8 psi is necessary to open the valve.
The PRV regulates pneumatically the downstream static pressure to:
- 52 psi maximum,
- 44 psi minimum.

The PRV will reduce the downstream static pressure by the ThS when the temperature downstream of the precooler exchanger is higher than 235 degrees Celsius.

BLEED SYSTEM ISOLATION FUNCTION

Each engine bleed system can be isolated from the pneumatic manifold in abnormal or specific conditions by closing the PRV.

MANUAL ISOLATION

The engine bleed system can be isolated manually from the pneumatic manifold by releasing the corresponding BLEED P/B on the AIR panel, and therefore energizing the ThS, resulting in the PRV closure.
The "FC/NOT FC" microswitch indicates the position of the valve to the BMC, which is displayed on the ECAM BLEED page.

FIRE ISOLATION

If an engine fire occurs, the bleed system of the affected engine is isolated by releasing the corresponding FIRE P/B on the overhead panel, energizing the ThS. The ECAM BLEED page shows the position of the PRVs.

G9409341 - GAUT0T0 - FM36D3000000006

AUTOMATIC ISOLATION

The BMC can isolate automatically engine bleed air supply by energizing the ThS:
- if a pylon or wing leak is detected,
- if an overpressure occurs,
- if an over temperature occurs,
- during engine start,
- during APU bleed supply.

OVERPRESSURE PROTECTION

If the bleed regulated pressure rises above 60 psi, the BMC detects an overpressure condition thanks to Pr and closes the PRV. A warning message is displayed on the EWD and the BLEED page comes up automatically on the SD showing the HPV and the PRV closed in amber. In addition to the overpressure electrical monitoring done by the BMC, the OPV gives a fully pneumatic back up protection in case of failure. The OPV is designed to start to close automatically when the upstream pressure increases above 75 psi and is fully closed at 85 psi. The valve remains closed as long as the upstream pressure is higher than 52 psi (±3 psi).

MONITORING

The bleed regulated pressure transducer is used for system monitoring and fault isolation regarding the PRV and OPV. An associated fault message is sent to the ECAM and to the Central Maintenance System (CMS) for maintenance purposes.

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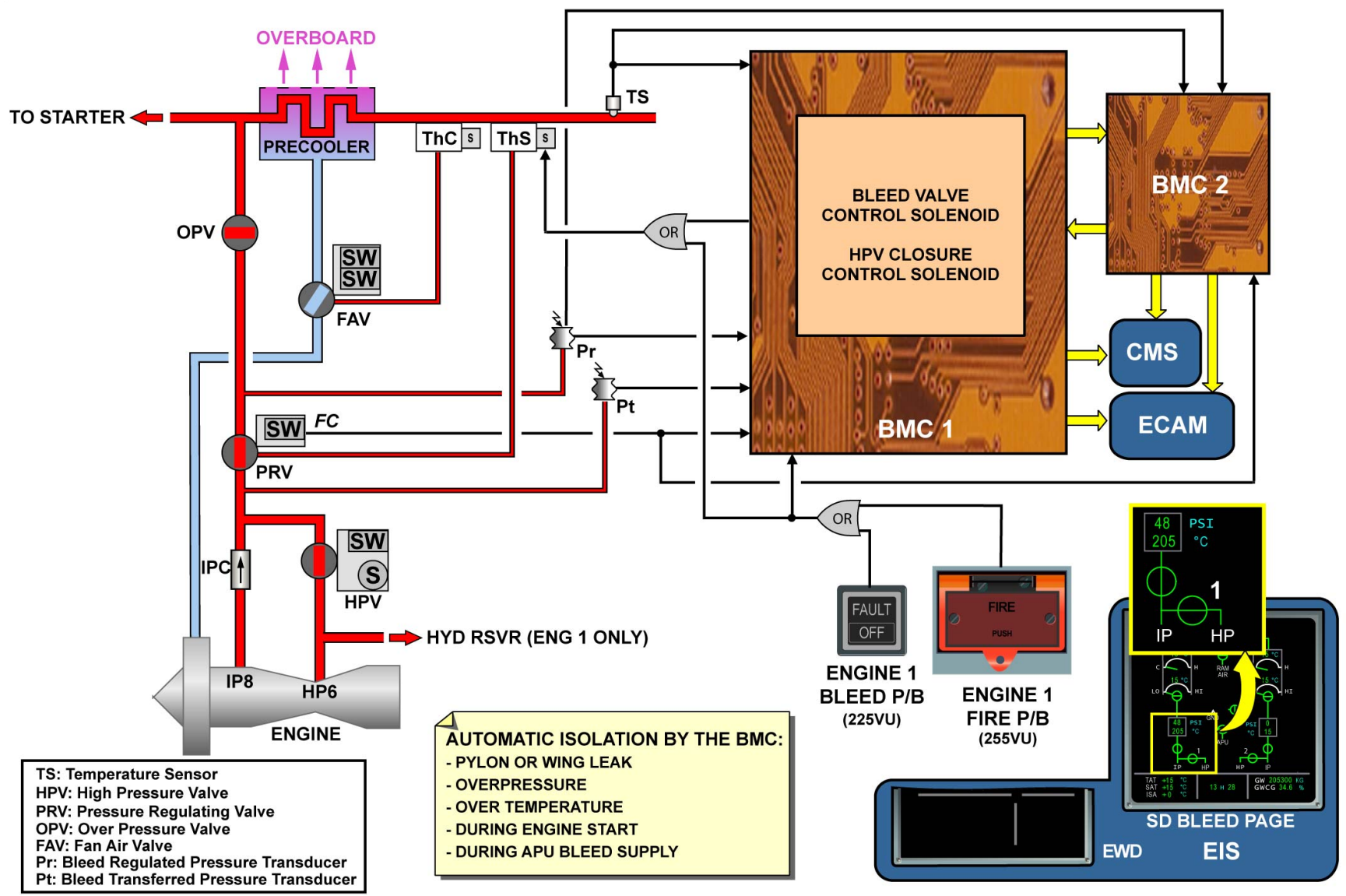

SYSTEM DESCRIPTION ... MONITORING

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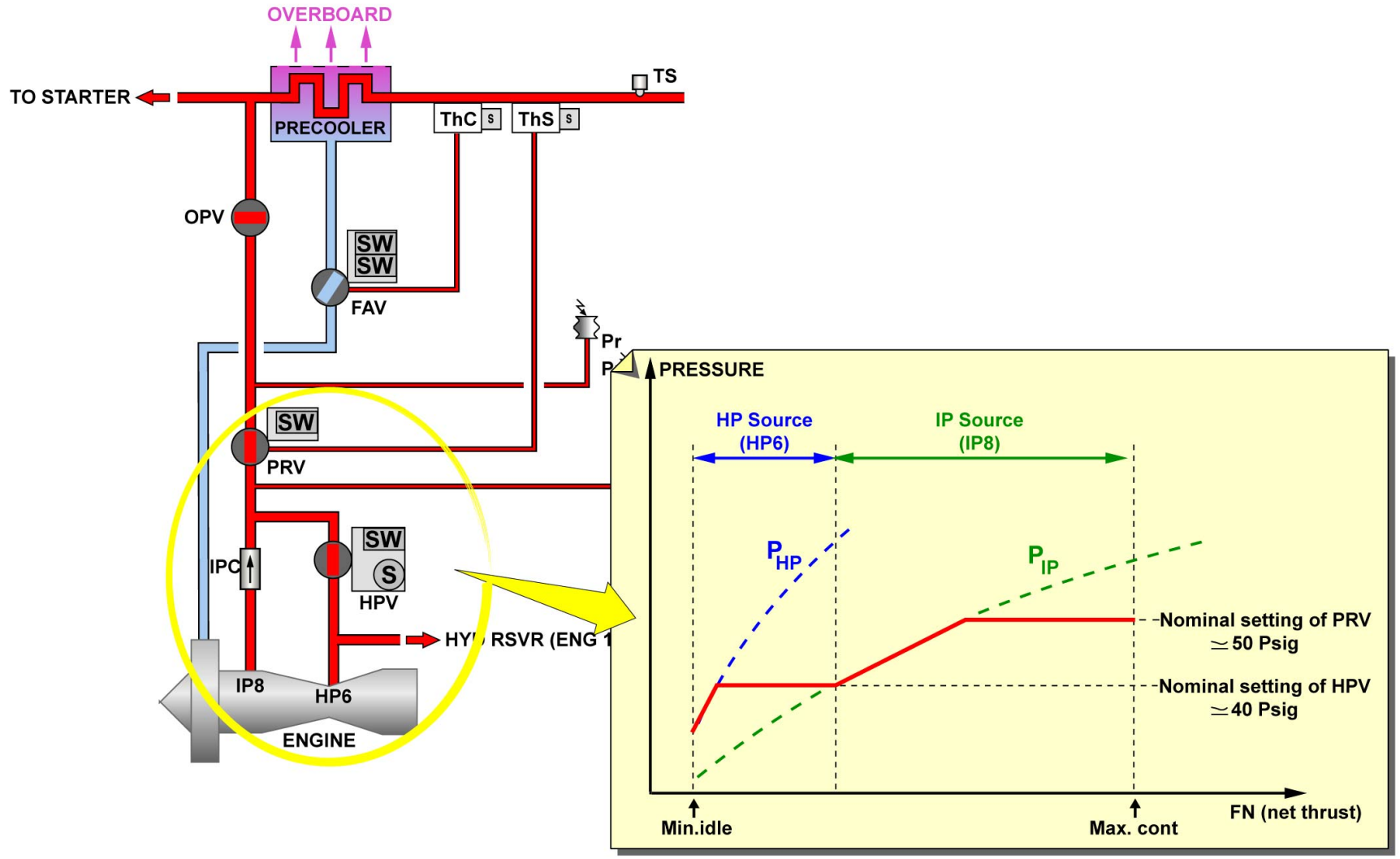

PRESSURE REGULATION - SUMMARY

SYSTEM DESCRIPTION ... MONITORING

G9409341 - GAUT0T0 - FM36D3000000006

ENGINE BLEED AIR TEMPERATURE REGULATION SYSTEM D/O (3)

GENERAL

The purpose of the engine bleed air temperature regulation system is to control the bleed air temperature supplied to the pneumatic manifold at two different settings.
These two temperature settings are:
- 200 degrees Celsius in nominal conditions or when the Wing Anti-Ice (WAI) system is operative,
- 150 degrees Celsius on air conditioning demand coming from the Zone Controller (ZC), when the WAI system is not operative.

In addition, it protects the user systems against bleed overheat and low temperature events.

DESCRIPTION

The temperature regulation system is composed of the following elements:
- the Fan Air Valve (FAV) associated to a Control Thermostat (ThC),
- the precooler,
- the bleed temperature sensor.

FAN AIR VALVE (FAV)

The FAV pneumatically regulates the fan airflow to the precooler for bleed air temperature regulation.
The valve is pneumatically controlled by the FAV ThC which supplies and controls the FAV motive pressure depending on the precooler outlet temperature. Without motive pressure the FAV is spring-loaded closed.
The FAV ThC has two temperature probes corresponding to the two temperature settings selected by means of a solenoid.
Fully Open (FO) and Fully Closed (FC) microswitches are installed on the valve for monitoring. For maintenance purposes, the FAV has a mechanical position indicator and a threaded hole which lets the butterfly be locked in the closed position with the vent screw.

PRECOOLER

The precooler is an air to air heat exchanger, located in the engine pylon. It uses engine fan air to cool air bled from the engine to a suitable temperature for the users.

OUTLET BLEED TEMPERATURE SENSOR

The bleed temperature sensor is a resistive platinum type dual sensor. Each sensing element of the bleed temperature sensor provides a temperature measurement to one Bleed Monitoring Computer (BMC). It is fitted on the bleed duct in the engine pylon, downstream of the precooler.

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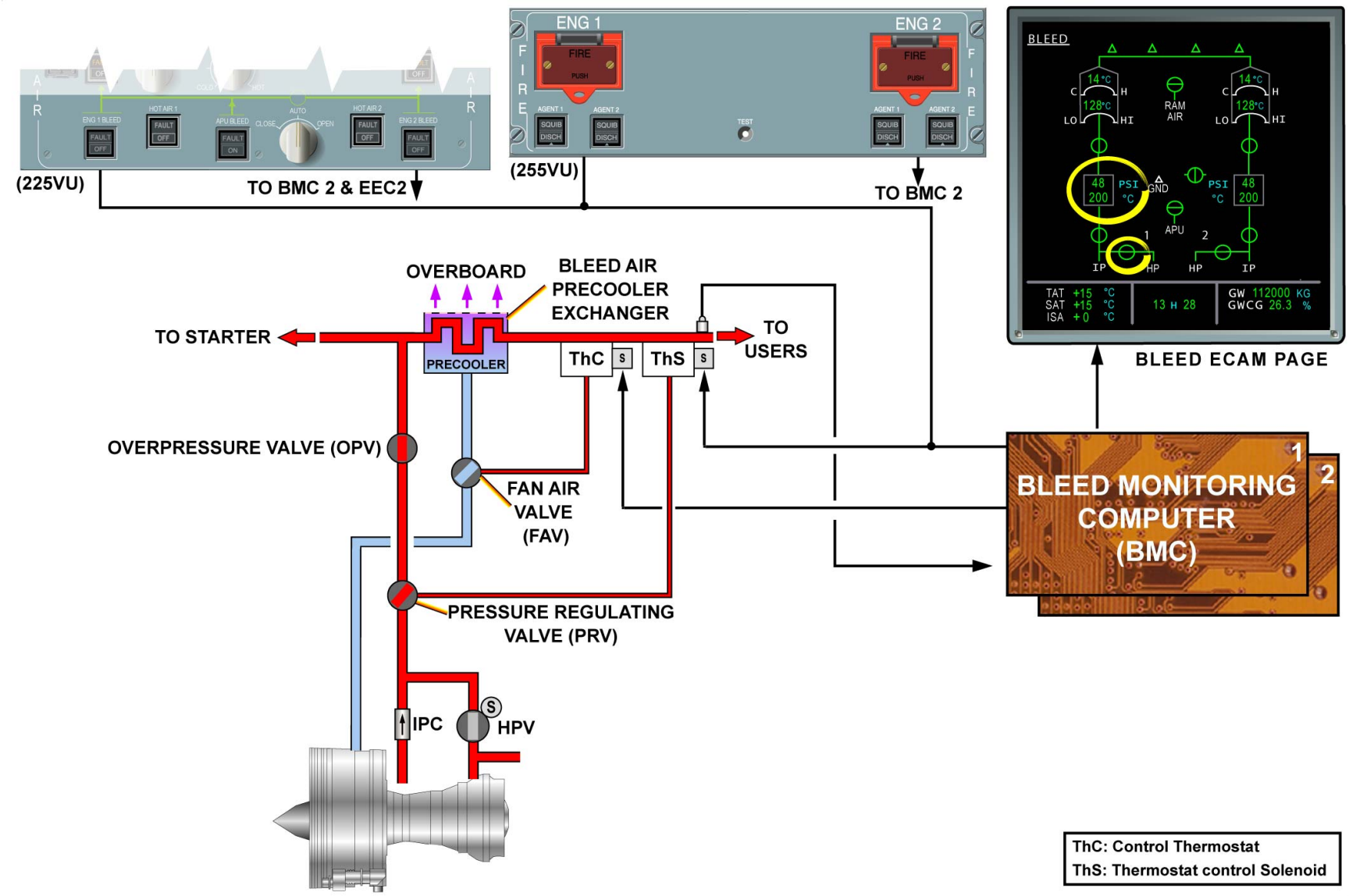

GENERAL & DESCRIPTION

G9409341 - GAUT0T0 - FM36D4000000006

ENGINE BLEED AIR TEMPERATURE REGULATION SYSTEM D/O (3)

TEMPERATURE REGULATION

The pressure used by the ThC is picked off from the outlet of the precooler exchanger. The pressure sent to the FAV opening chamber is modulated by the expansion of the temperature probes.
The normal 200 degrees Celsius temperature demand can be switched to 150 degrees Celsius if requested by the ZC, provided ANTI ICE WING P/B is not selected ON. In this case the solenoid is energized by the BMC and the second probe becomes active.

TEMPERATURE LIMITATION AND OVERHEAT DETECTION

The bleed temperature limitation function overrides the bleed pressure control.
This limitation is activated by the ThS when the bleed temperature exceeds 235 degrees Celsius. The FAV being already fully opened, the ThS will command the Pressure Regulating Valve (PRV) to reduce the bleed air flow in order to lower the temperature.
Above 257 degrees Celsius the PRV is controlled automatically closed by the BMC, the temperature displayed on the ECAM turns to amber and an ECAM message comes up.

LOW TEMPERATURE DETECTION

When the ANTI ICE WING P/B is ON, a low temperature is detected by the BMC if the temperature read by the bleed temperature sensor is below 150 degrees Celsius. A warning is triggered on the ECAM and the bleed temperature is displayed in amber.

MONITORING

FAV operation monitoring and fault isolation is done when an overheat or a low temperature event occurs by analyzing the feedback of the two FAV position microswitches. An associated fault message is sent to the ECAM and to the Central Maintenance System (CMS) for maintenance purposes.

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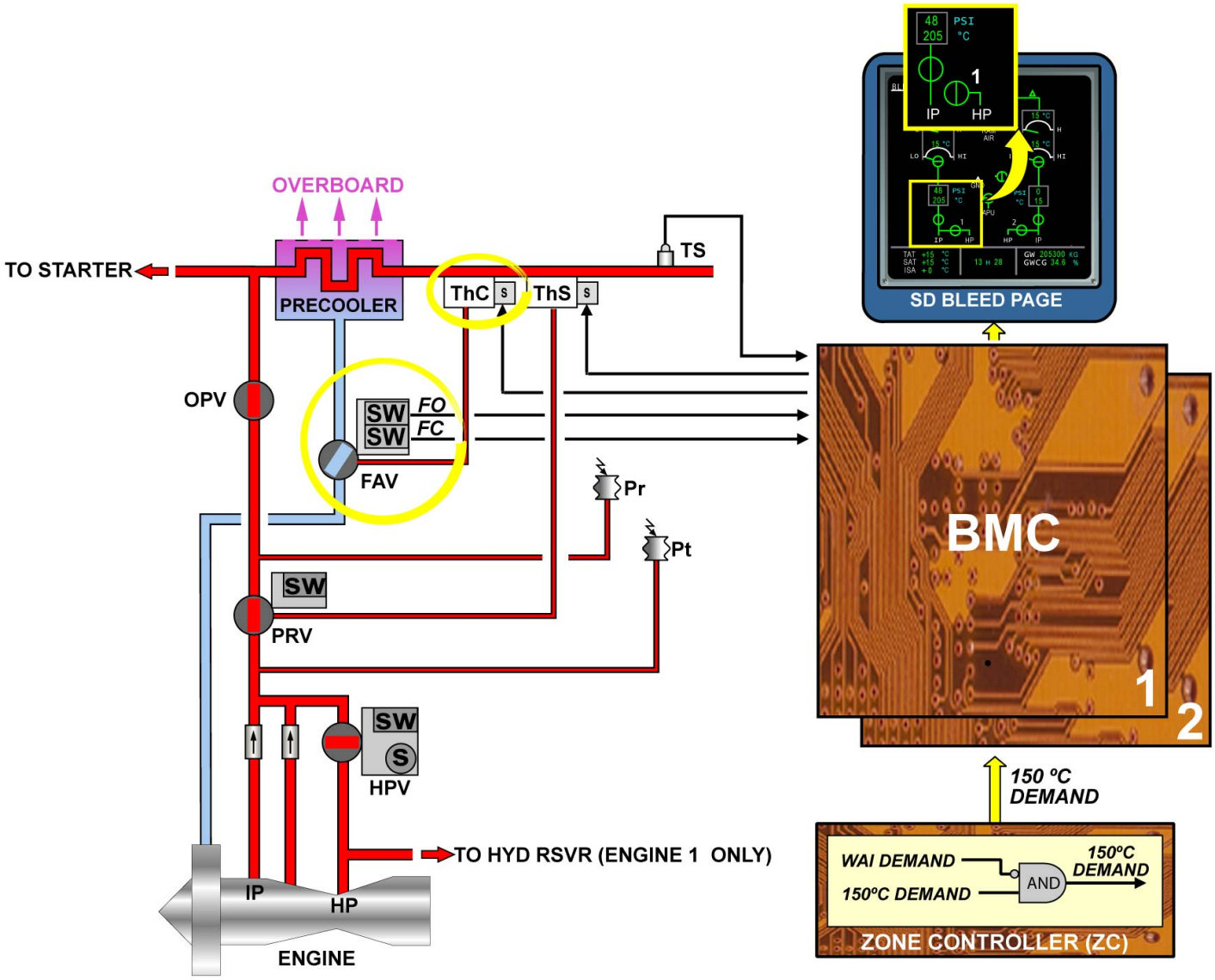


TEMPERATURE REGULATION & MONITORING

G9409341 - GAUT0T0 - FM36D4000000006

LEAK DETECTION SYSTEM D/O (3)

GENERAL

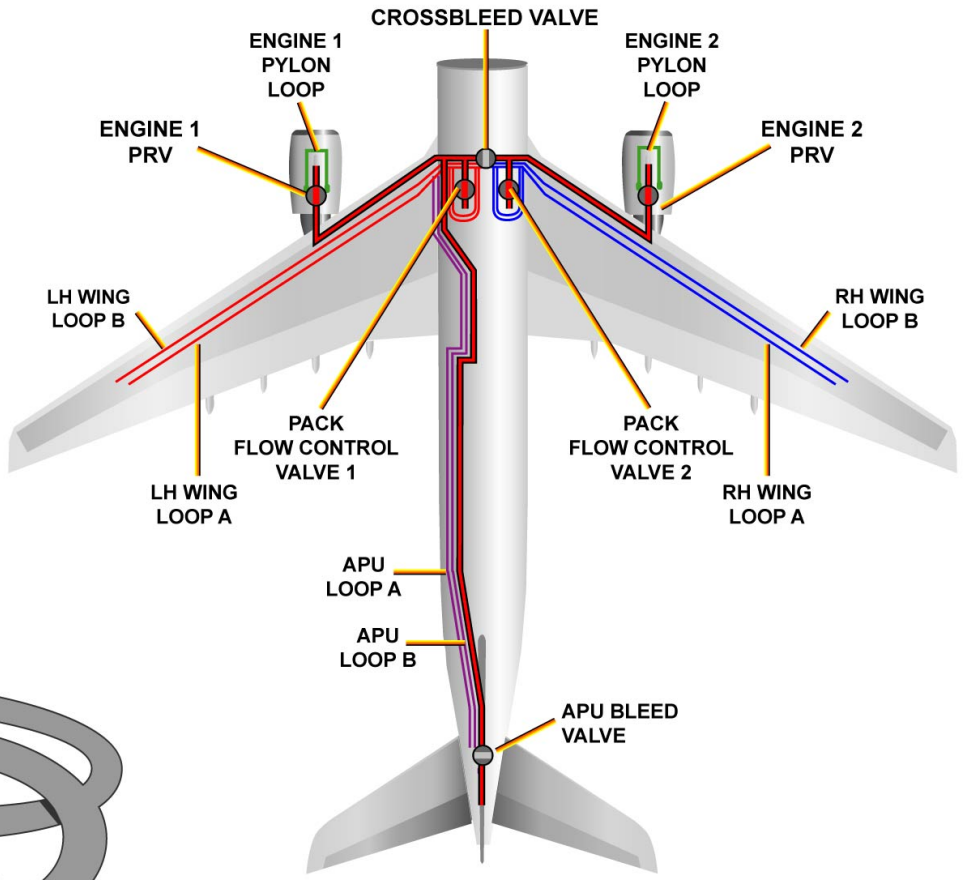
The leak detection system is divided into two sub-systems, left and right. The separation is made at the crossbleed valve level.
The detection loops are located along the bleed air network. Each loop is composed of overheat sensing elements connected in series.
Dual loop detection systems are installed in the wings, packs and crossbleed valve area and the APU bleed duct area. A single loop detection system is installed in the pylons.

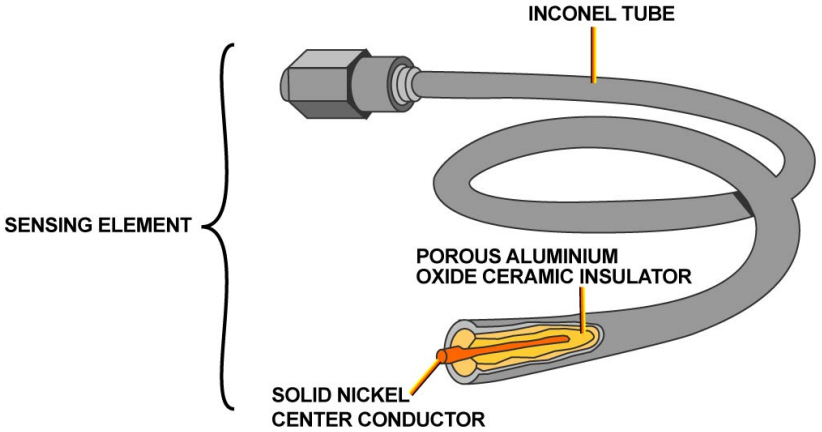
SENSING ELEMENTS

The sensing elements have a solid center conductor set in an aluminum oxide insulator and are integrated in an outer tube connected to A/C ground. Eutectic salt fills the space between the outer tubing and the center conductor.
Each sensing element is permanently subjected to the temperature of the compartment it protects. For any temperature higher than a preset value and applied to a small length of the element, the resistance of the eutectic salt rapidly decreases and continuity is established between the tube and the conductor. The center conductor is grounded.

G9409341 - GAUT0T0 - FM36D5000000004

LOOP	TEMPERATURE
Pylon 1,2	200ºC
LH Wing Bleed Duct	124ºC
RH Wing Bleed Duct	124ºC
APU Duct	124ºC between FR56 and FR80/92 157ºC between FR80/92 and FR95





GENERAL & SENSING ELEMENTS

LEAK DETECTION SYSTEM D/O (3)

BMC LOOP MONITORING

Each Bleed Monitoring Computer (BMC) monitors four detection loops:
- one in the engine pylon,
- one in the LH wing and above the LH pack,
- one in the RH wing and above the RH pack,
- one APU loop.

Both BMCs exchange loop status data via ARINC buses. BMC 1 sends an APU leak discrete signal to BMC 2.
If one BMC operation is lost, the other BMC takes over for wing/pack and APU leak monitoring but the corresponding pylon leak detection is lost.

LEAK DETECTION OPERATION

As soon as a leak occurs, the hot air increases the temperature of the affected area detection loops and thus modifies their resistance. This resistance change is detected by the corresponding BMC which isolates the affected system by closing the relevant valves.
During APU bleed operation, if a hot air leak is detected, a closure demand is sent by the BMC to the Electronic Control Box (ECB) which does the APU bleed valve closure control, except during Main Engine Start (MES) sequence.
If the APU bleed valve is commanded closed and the crossbleed valve selector is in the AUTO mode, the crossbleed valve closes too.
As soon as a leak is detected, a warning message is displayed on the EWD. In addition, the AIR panel BLEED P/BSWs are used to indicate leaks and their FAULT legend comes on in amber.
The FAULT legend of engine 1 BLEED P/BSW comes on if a leak is detected in the left pneumatic manifold.
The FAULT legend of engine 2 BLEED P/BSW comes on if a leak is detected in the right pneumatic manifold.
The FAULT legend of APU BLEED P/BSW comes on if a leak is detected in the APU bleed air system.
The FAULT legend of the BLEED P/BSWs remains on as long as the hot air leak continues.

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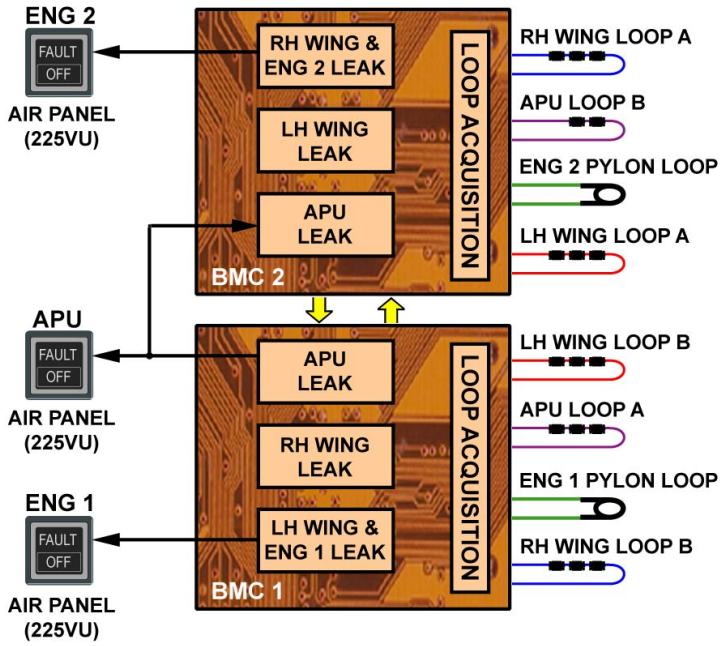
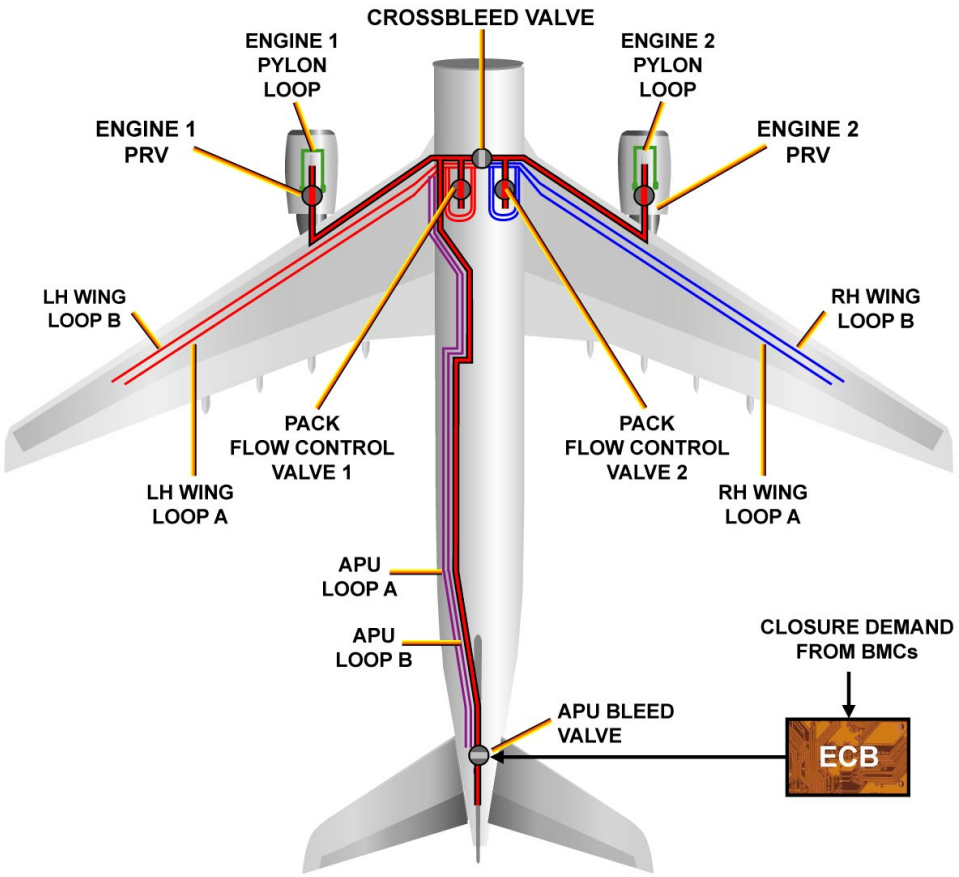


	AUTOMATIC RESPONSE / VALVE CLOSURE			
Type of failure	Eng 1 bleed valve	Eng 2 bleed valve	Cross-bleed valve	APU bleed valve
Left wing leak (wing or Xbleed)	X		X *	X *
Right wing leak (wing or Xbleed)		X	X *	
Engine 1 pylon leak	X		X *	X *
Engine 2 pylon leak		X	X *	
APU leak			X	X

* EXCEPT DURING ENGINE START SEQUENCE



BMC LOOP MONITORING & LEAK DETECTION OPERATION

G9409341 - GAUT0T0 - FM36D5000000004

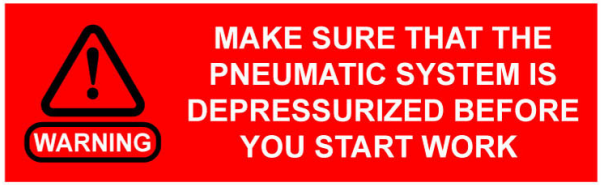
PNEUMATIC SYSTEM BASE MAINTENANCE (3)

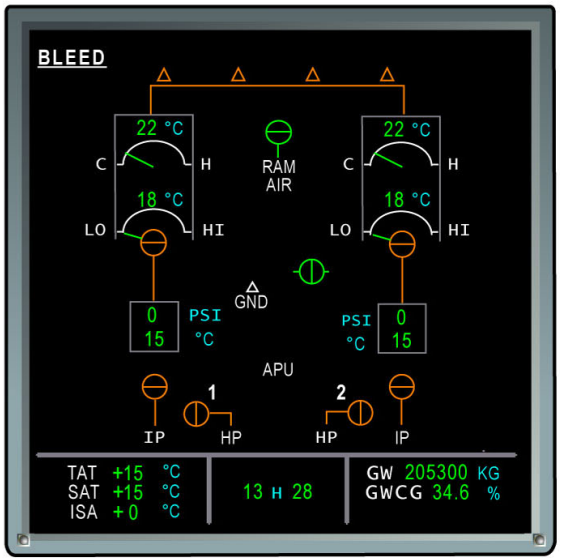
INTRODUCTION

WARNING: PARTS CAN BE HOT FOR 1 HOUR AFTER ENGINE SHUT DOWN.

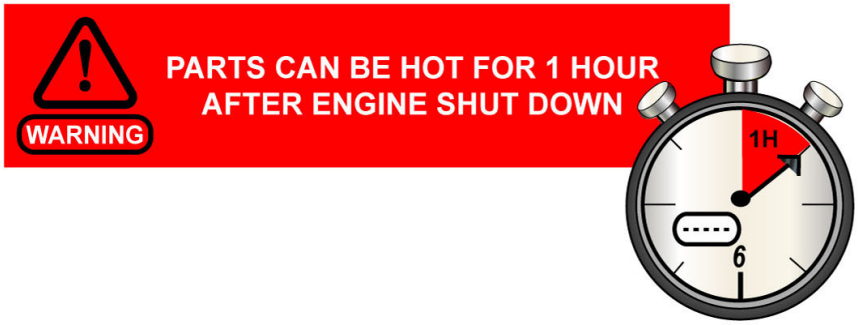
WARNING: MAKE SURE THAT THE PNEUMATIC SYSTEM IS DEPRESSURIZED BEFORE YOU START WORK. PRESSURIZED AIR CAN CAUSE INJURY TO PERSONS.

G9409341 - GAUT0T0 - FM36Y2BASEMCE04





ECAM BLEED PAGE



INTRODUCTION

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

PNEUMATIC SYSTEM BASE MAINTENANCE (3)

FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER

This task enables to check the bleed transferred pressure transducer using an external compressed air.

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

Functional Test of the Bleed Transferred Pressure Transducer

...

Job set-up

...

- Safety precautions.
- Get access.
- Aircraft maintenance configuration.

...

Procedure

...

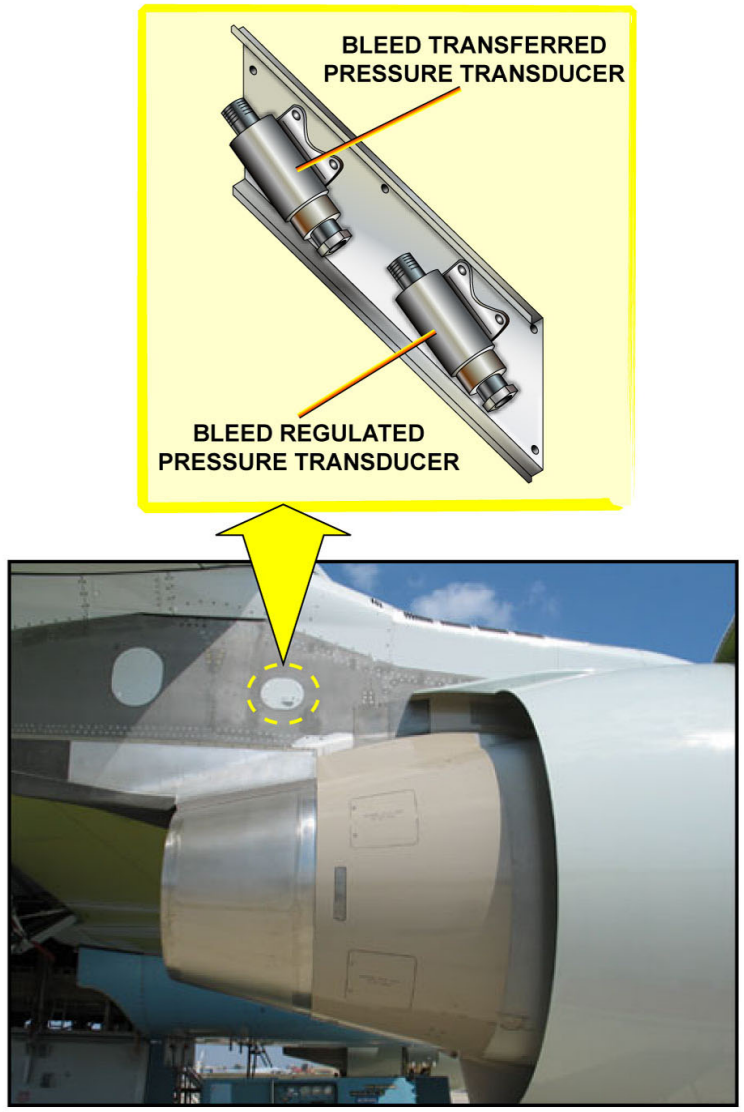
- Functional test of the bleed transferred pressure transducer.

...

Close-up

...

- Aircraft maintenance configuration.
- Do the BITE test of the BMC.
- Close access.



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER

PNEUMATIC SYSTEM BASE MAINTENANCE (3)

FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER (continued)

JOB SET-UP

In the cockpit, after energizing the A/C electrical circuits, make sure that the ENG system and the bleed system are de-energized and put warning notices on the ENG START panel (145VU), ENG MASTER control panel (125VU), ENG section of the maintenance panel (285VU) and AIR control panel (225VU) to tell people not to operate these systems.
On the High Pressure (HP) ground connectors located on the belly fairing, put a warning notice to tell people not to pressurize the pneumatic system.
Get access to the top of the pylon and remove the applicable panels to reach the transferred pressure transducer.
Disconnect the electrical connector from the bleed transferred pressure transducer and the bleed regulated pressure transducer.
Use the cable bundle from the TEST SET (98F36003002000 or 98D36003000001) to connect the electrical connector of the transferred pressure transducer and the regulated pressure transducer.
Disconnect the sense line from the transferred pressure transducer.

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

Functional Test of the Bleed Transferred Pressure Transducer

...
Job set-up
...

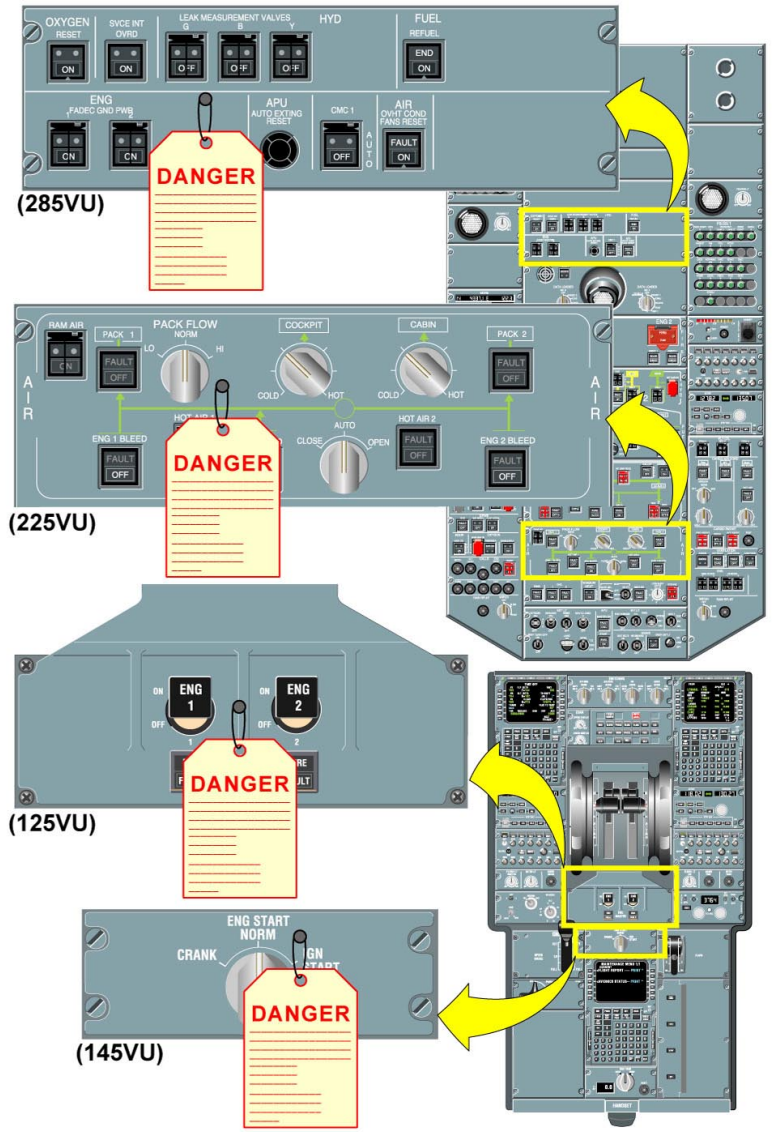
- Safety precautions.
- Get access.
- Aircraft maintenance configuration.

...
Procedure
...

- Functional test of the bleed transferred pressure transducer.

...
Close-up
...

- Aircraft maintenance configuration.
- Do the BITE test of the BMC.
- Close access.



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - JOB SET-UP

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

Functional Test of the Bleed Transferred Pressure Transducer

...

Job set-up

...

- **Safety precautions.**
- **Get access.**
- **Aircraft maintenance configuration.**

...

Procedure

...

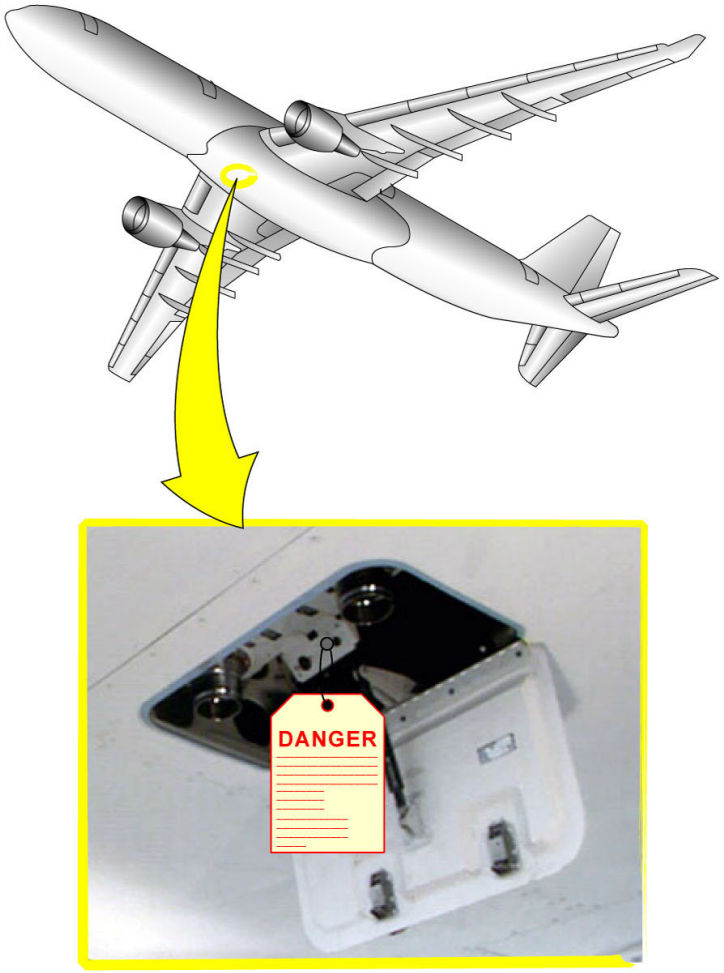
- **Functional test of the bleed transferred pressure transducer.**

...

Close-up

...

- **Aircraft maintenance configuration.**
- **Do the BITE test of the BMC.**
- **Close access.**



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - JOB SET-UP

Functional Test of the Bleed Transferred Pressure Transducer

...

Job set-up

...

- ✓ Safety precautions.
- ⇨ Get access.
- Aircraft maintenance configuration.

...

Procedure

...

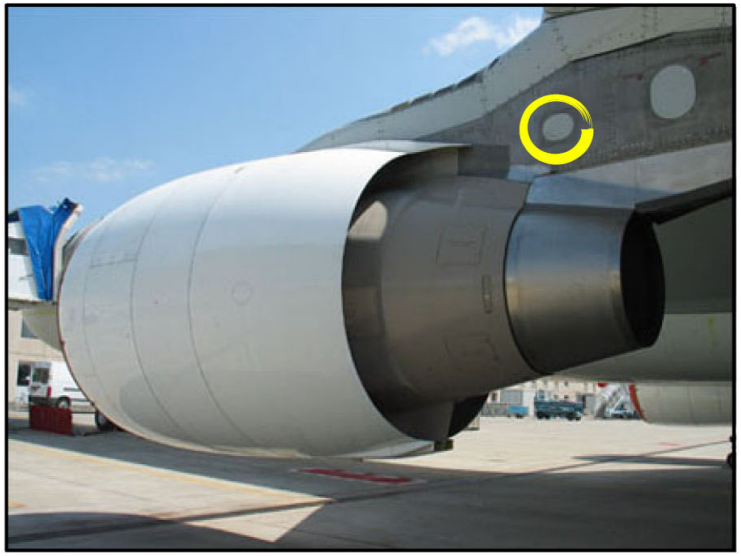
- Functional test of the bleed transferred pressure transducer.

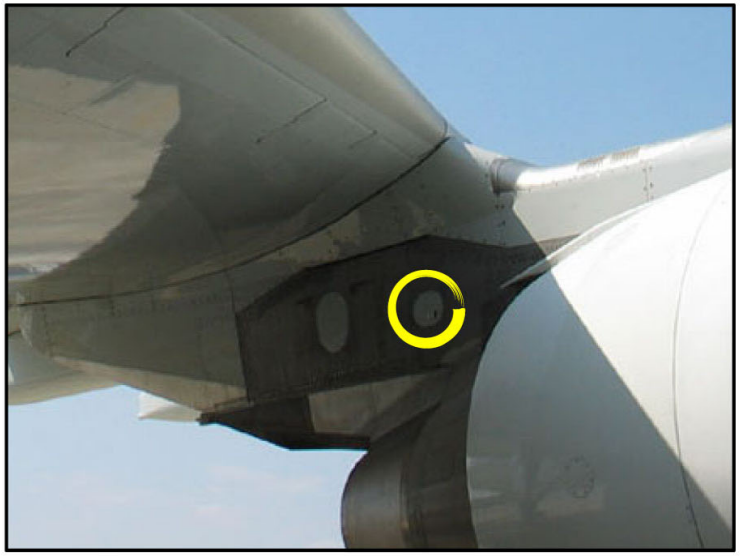
...

Close-up

...

- Aircraft maintenance configuration.
- Do the BITE test of the BMC.
- Close access.





FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - JOB SET-UP

Functional Test of the Bleed Transferred Pressure Transducer

...

Job set-up

...

✓ **Safety precautions.**

✓ **Get access.**

⇨ **Aircraft maintenance configuration.**

Disconnect the electrical connector from the transferred pressure transducer and the regulated pressure transducers.

Use the cable bundle from the TEST SET to connect the electrical connectors of the transferred and regulated pressure transducers.

Disconnect the sense line from the transferred pressure transducer.

...

Procedure

...

Functional test of the bleed transferred pressure transducer.

...

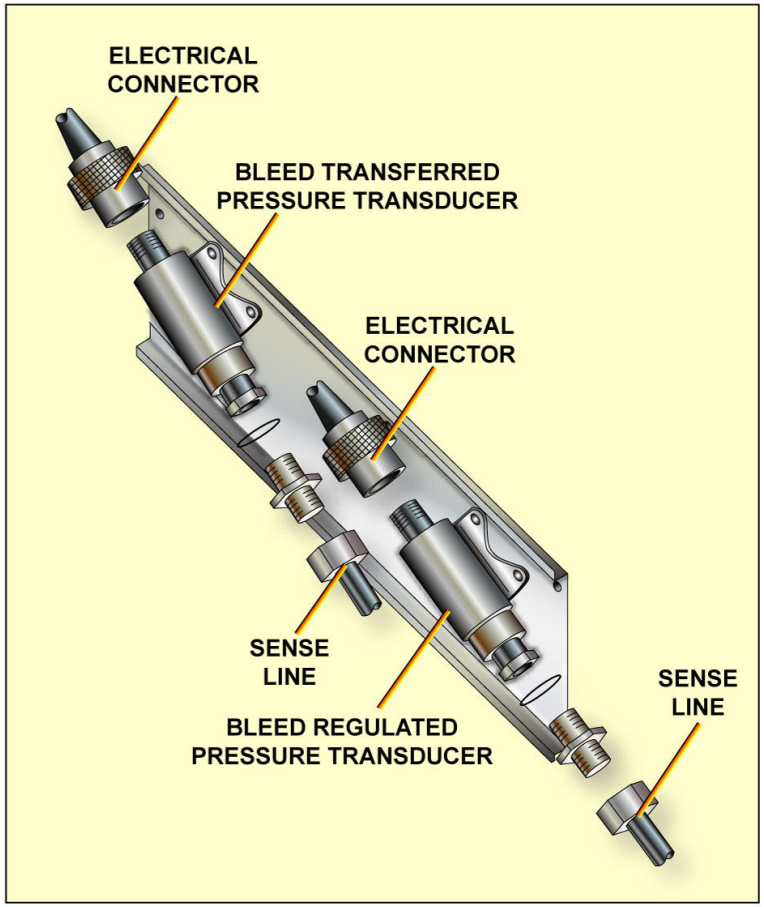
Close-up

...

Aircraft maintenance configuration.

Do the BITE test of the BMC.

Close access.



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - JOB SET-UP

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G9409341 - GAUT0T0 - FM36Y2BASEMCE04

PNEUMATIC SYSTEM BASE MAINTENANCE (3)

FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER (continued)

PROCEDURE

Connect the TEST SET supply to the transducer pressure port.
Push the BLEED key on the ECAM control panel to show the ECAM BLEED page.
On the TEST SET, open the shut off valve of the air cylinder.
Use the primary pressure regulator to pressurize the TEST SET to 100 psi.
Then use the pressure regulator No.1 to slowly pressurize the transducer from 10 to 90 psi.
On the BLEED page, check that the pressure value agrees with the pressure gage No.1 plus or minus 2 psi.

Functional Test of the Bleed Transferred Pressure Transducer

...

✓ Job set-up

...

✓ Safety precautions.

✓ Get access.

✓ Aircraft maintenance configuration.

...

Procedure

...

⇨ **Functional test of the bleed transferred pressure transducer.**

✓ Connect the TEST SET supply to the transducer pressure port.

⇨ Push the BLEED key on the ECAM control panel.

On the TEST SET open the shut off valve of the air cylinder.

Use the primary regulator to pressurize the pressure source to 100 PSI (6.9 bar).

Slowly pressurize the system No.1 from 10 PSI (0.69 bar) to 90 PSI (6.21 bar).

On the BLEED page, the pressure must agree with the value of the pressure gage No.1 plus or minus 2 PSI.

...

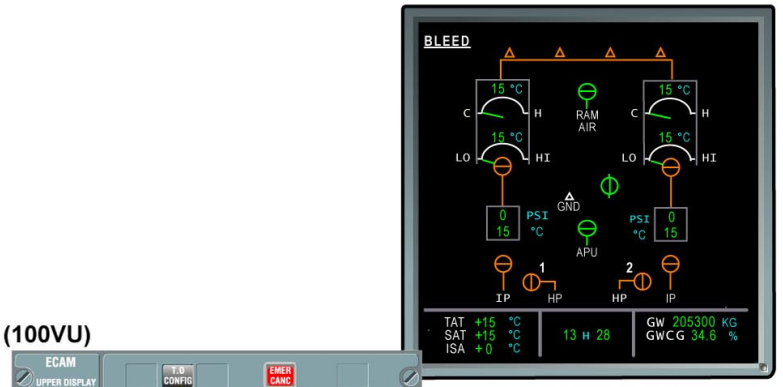
Close-up

...

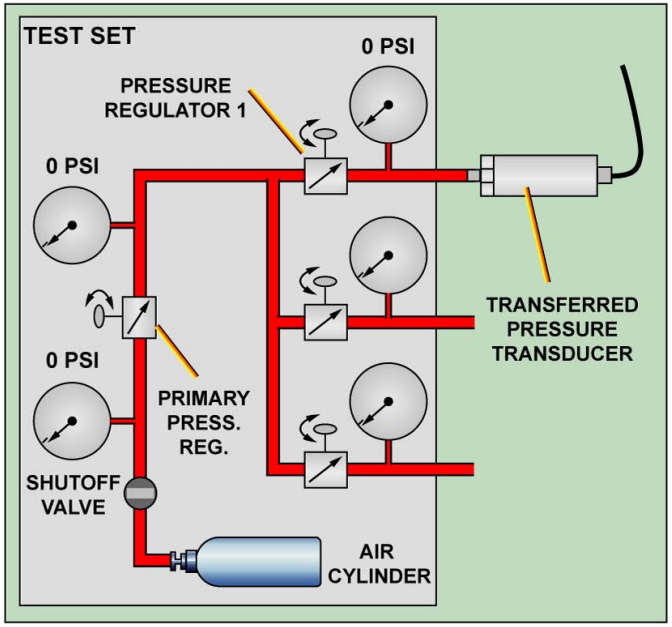
Aircraft maintenance configuration.

Do the BITE test of the BMC.

Close access.



BLEED ECAM PAGE



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - PROCEDURE

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

Functional Test of the Bleed Transferred Pressure Transducer

...

✓ **Job set-up**

...

✓ **Safety precautions.**

✓ **Get access.**

✓ **Aircraft maintenance configuration.**

...

Procedure

...

⇨ **Functional test of the bleed transferred pressure transducer.**

- ✓ Connect the TEST SET supply to the transducer pressure port.
- ✓ Push the BLEED key on the ECAM control panel.
- ✓ On the TEST SET open the shut off valve of the air cylinder.
- ✓ Use the primary regulator to pressurize the pressure source to 100 PSI (6.9 bar).
- ✓ Slowly pressurize the system No.1 from 10 PSI (0.69 bar) to 90 PSI (6.21 bar).
- ⇨ On the BLEED page, the pressure must agree with the value of the pressure gage No.1 plus or minus 2 PSI.

...

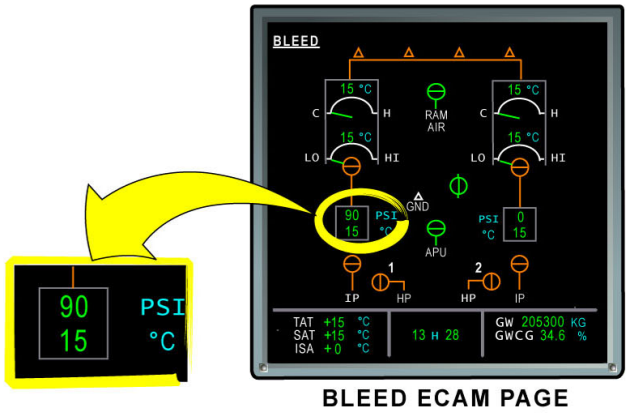
Close-up

...

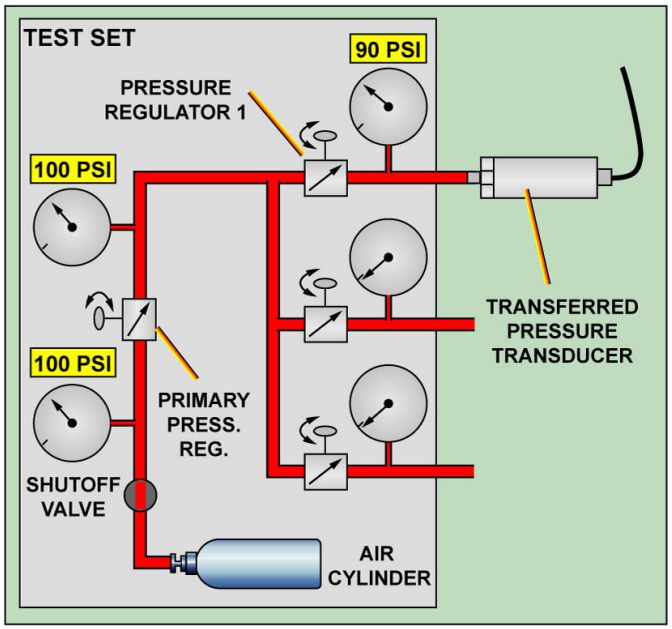
Aircraft maintenance configuration.

Do the BITE test of the BMC.

Close access.

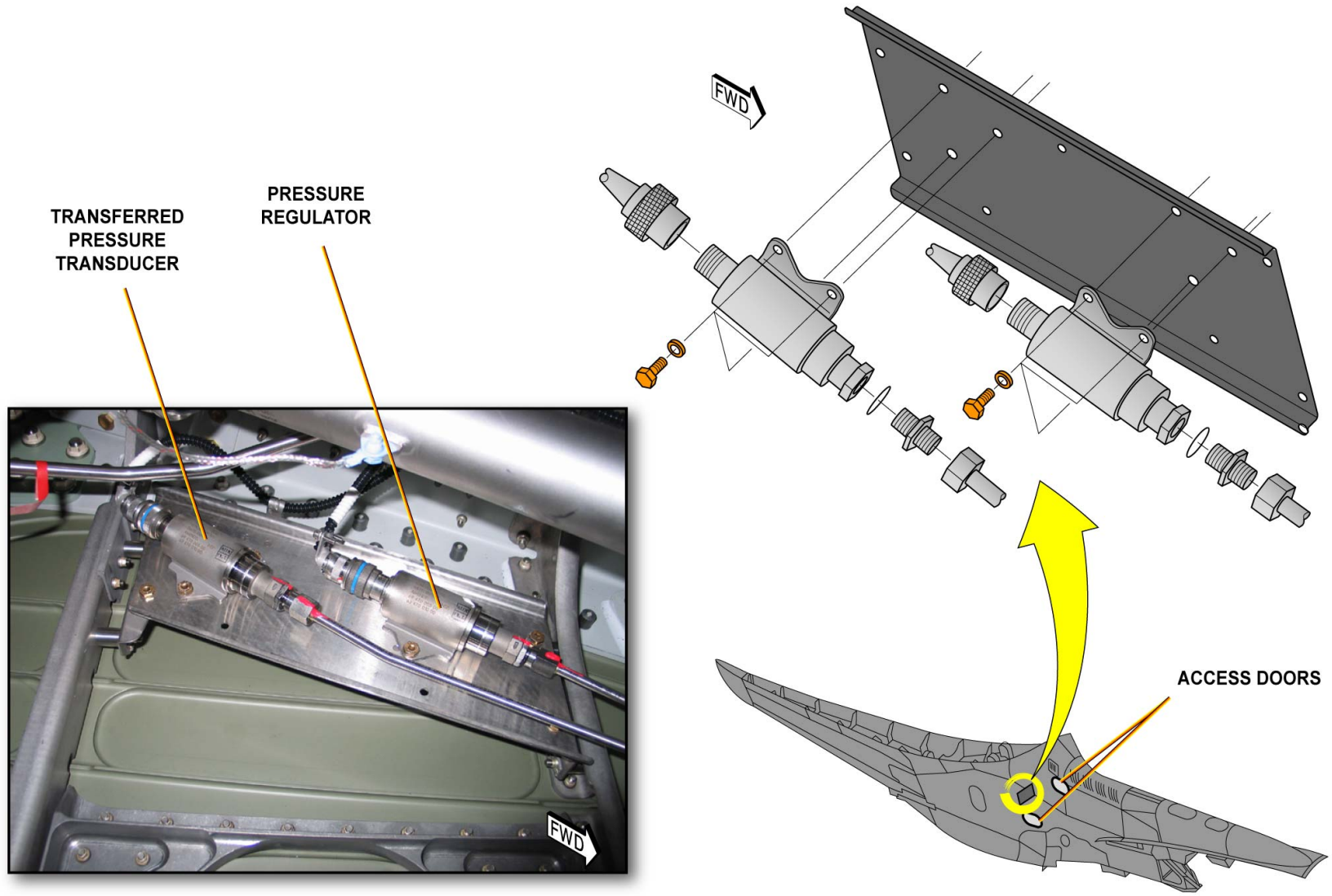


BLEED ECAM PAGE



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - PROCEDURE

G9409341 - GAUT0T0 - FM36Y2BASEMCE04



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - PROCEDURE

PNEUMATIC SYSTEM BASE MAINTENANCE (3)

FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER (continued)

CLOSE-UP

Depressurize the TEST SET.
Disconnect the TEST SET from the bleed transferred pressure transducer and reconnect it to the sense line.
Disconnect the cable bundle from the pressure transducers and reconnect the electrical connectors of the transducers.
On the MCDU, on the corresponding Bleed Monitoring Computer (BMC) page, do a BITE TEST by selecting TEST.
To launch the BITE TEST, press START TEST and wait until the test ends.
Once the TEST is finished, check that there are no maintenance messages related to the transducer.
Close the applicable access panels and put the A/C back to its initial configuration.

Functional Test of the Bleed Transferred Pressure Transducer

...

✓ Job set-up

...

✓ Safety precautions.

✓ Get access.

✓ Aircraft maintenance configuration.

...

✓ Procedure

...

✓ Functional test of the bleed transferred pressure transducer.

...

Close-up

...

⇨ **Aircraft maintenance configuration.**

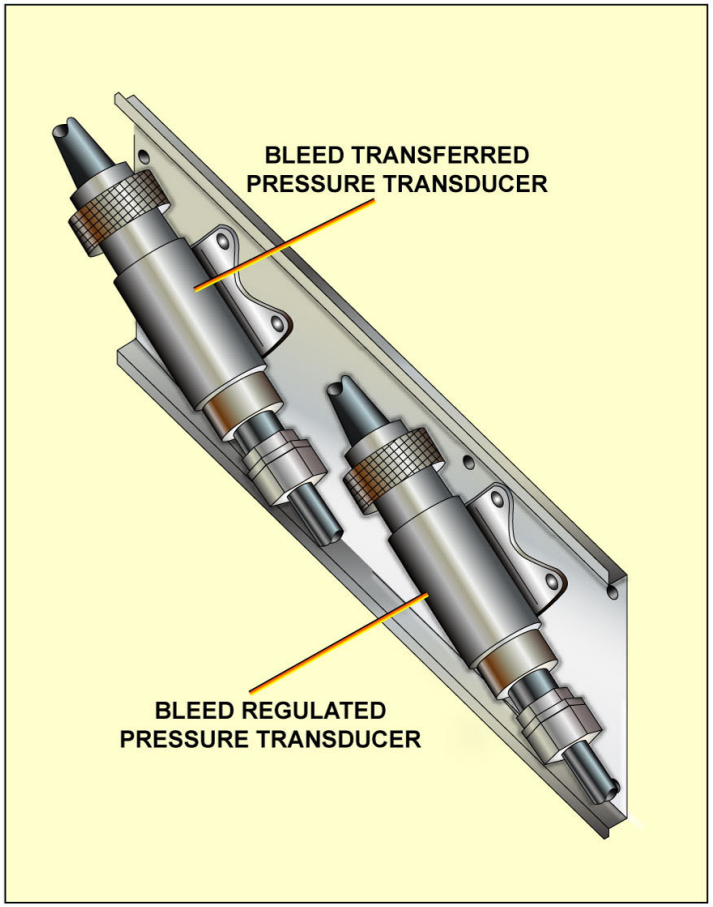
Depressurize the TEST SET.

Disconnect the TEST SET from the transferred pressure transducer and reconnect it to the sense line.

Disconnect the cable bundle from the pressure transducers and reconnect the electrical connectors.

Do the BITE test of the BMC.

Close access.



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - CLOSE-UP

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

Functional Test of the Bleed Transferred Pressure Transducer

...

✓ Job set-up

...

✓ Safety precautions.

✓ Get access.

✓ Aircraft maintenance configuration.

...

✓ Procedure

...

✓ Functional test of the bleed transferred pressure transducer.

...

Close-up

...

✓ Aircraft maintenance configuration.

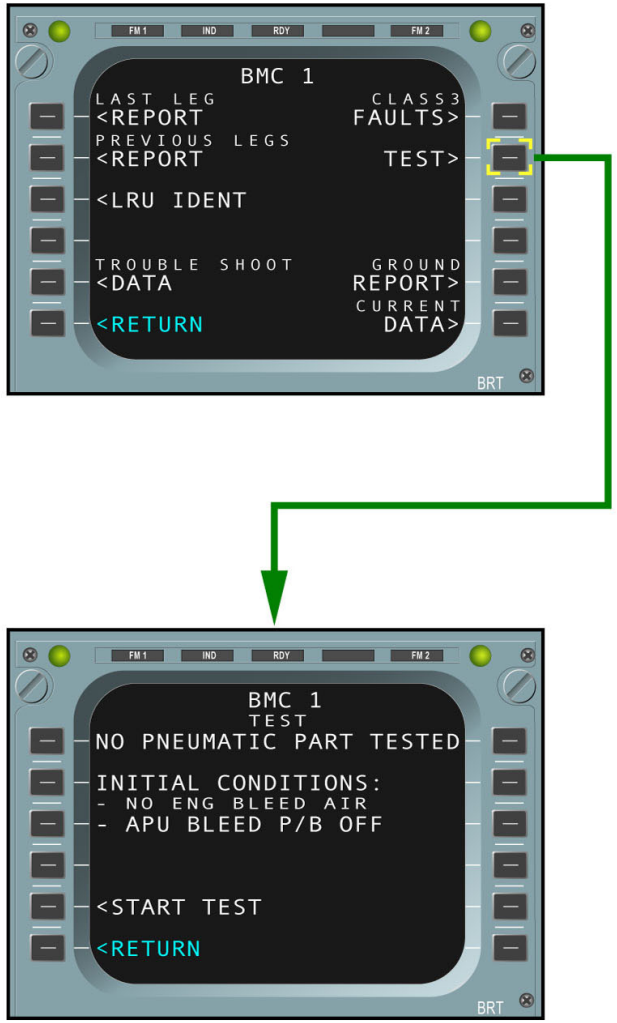
⇨ Do the BITE test of the BMC.

⇨ Press the TEST key on the corresponding BMC page of the MCDU.

Press the START TEST key and wait until the test ends.

Check that there are no maintenance messages related to the transducer.

Close access.



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - CLOSE-UP

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

Functional Test of the Bleed Transferred Pressure Transducer

...

✓ Job set-up

...

✓ Safety precautions.

✓ Get access.

✓ Aircraft maintenance configuration.

...

✓ Procedure

...

✓ Functional test of the bleed transferred pressure transducer.

...

Close-up

...

✓ Aircraft maintenance configuration.

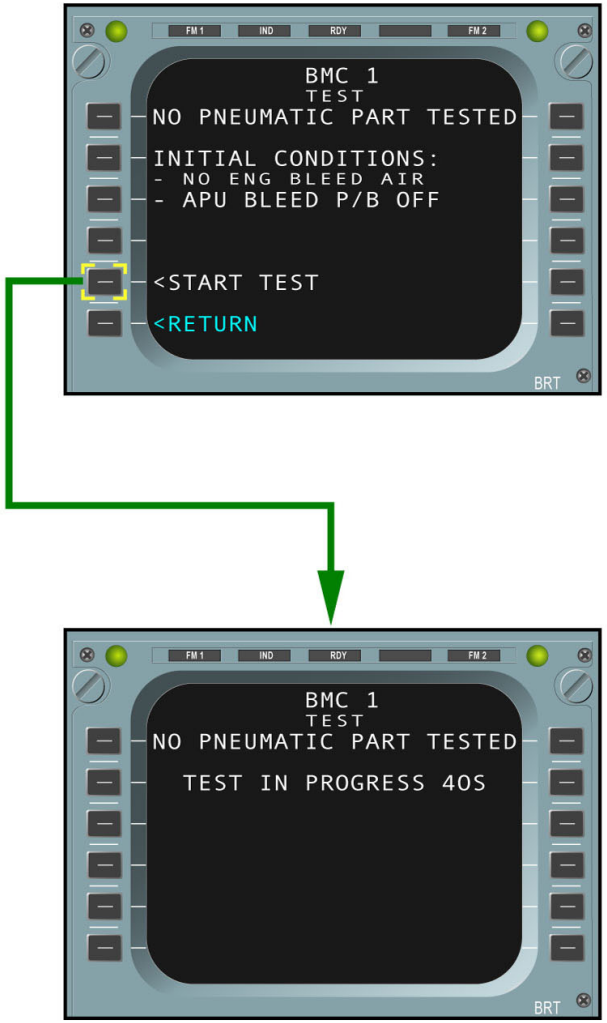
⇨ **Do the BITE test of the BMC.**

✓ Press the TEST key on the corresponding BMC page of the MCDU.

⇨ Press the START TEST key and wait until the test ends.

Check that there are no maintenance messages related to the transducer.

Close access.



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - CLOSE-UP

G9409341 - GAUT0T0 - FM36Y2BASEMCE04

Functional Test of the Bleed Transferred Pressure Transducer

...

✓ **Job set-up**

...

✓ **Safety precautions.**

✓ **Get access.**

✓ **Aircraft maintenance configuration.**

...

✓ **Procedure**

...

✓ **Functional test of the bleed transferred pressure transducer.**

...

Close-up

...

✓ **Aircraft maintenance configuration.**

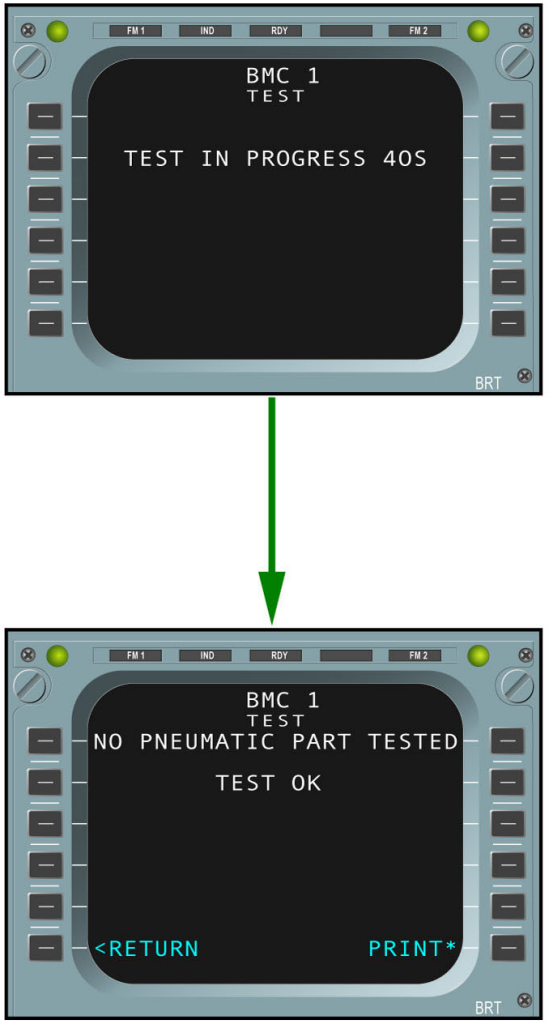
⇨ **Do the BITE test of the BMC.**

✓ Press the TEST key on the corresponding BMC page of the MCDU.

✓ Press the START TEST key and wait until the test ends.

⇨ Check that there are no maintenance messages related to the transducer.

Close access.



FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - CLOSE-UP

Functional Test of the Bleed Transferred Pressure Transducer

...

✓ Job set-up

...

✓ Safety precautions.

✓ Get access.

✓ Aircraft maintenance configuration.

...

✓ Procedure

...

✓ Functional test of the bleed transferred pressure transducer.

...

✓ Close-up

...

✓ Aircraft maintenance configuration.

✓ Do the BITE test of the BMC.

✓ Close access.

TASK COMPLETED

FUNCTIONAL TEST OF THE BLEED TRANSFERRED PRESSURE TRANSDUCER - CLOSE-UP

AIRBUS

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